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Results of a Survey of Mosquitoes Conducted at London, Ontario in 1952 with Observations on the Biology of the Species Collected[1]

By W. W. Judd[2]

Introduction

In Canada surveys of mosquito populations have been conducted on a scale varying from country-wide programmes to local surveys about centres of population. The work of the Defence Research Board and Department of Agriculture in conducting surveys and biological studies of mosquitoes across northern Canada has been reviewed by Twinn (1950, 1952) and Freeman (1952). During 1944 a country-wide survey, particularly of anopheline species, was conducted as part of a study of possible transmission of malaria (Twinn, 1944). In the Fraser River Valley Hearle (1926) studied the distribution and biology of the mosquitoes of that region. Surveys of a local nature around centres of population have been conducted by McLintock (1944) at Winnipeg, by Urquhart (1948) at Toronto and by Judd (1950) at Hamilton as a basis for control programmes at these centres. During 1952 such a survey, the subject of this paper, was carried out at London, Ontario and its vicinity to determine what species were present in the region, the times of occurrence of larvae and pupae in pools and the seasonal abundance of adults of each species.

Collection of Larvae and Pupae

Larvae and pupae were collected from pools in six localities in London and vicinity (Fig. 1: A-F) each locality being visited once a week from April 21 to September 15, 1952. In each locality eight pools, e.g. pools A1 to A8 (Fig. 1), were chosen and the populations of larvae and pupae were sampled in each pool. A cloth dipper of 24 square-inch area was swept through the water for a distance of about one yard and the number of larvae and pupae so collected was counted. The "larval ratio" and "pupal ratio" were calculated by dividing the number of larvae and the number of pupae collected by the number of dips made in the pool. These ratios were plotted to show what changes occurred in the population of larvae and pupae during the season in each pool (Figs. 4-6). The larvae and pupae from each collection were placed in a jar of water from the pool and were taken to the laboratory. Some larvae and pupae from each pool were reared individually in small cotton-covered jars, the remaining specimens being preserved in vials bearing the number of the pool and date of the collection. For each specimen reared the dates of larval and pupal moults and the emergence of the adult were recorded. For identification later, larval and pupal exuviae were preserved in fluid and adults were pinned.

Collection of Adults

Adults in flight were collected in each of the six localities, A-F, on the same day as larvae and pupae were being collected. They were swept from the air and nearby vegetation by three circular sweeps around the collector, this sweeping being repeated in the vicinity of each of the eight pools. In some cases adults alighting on the collector were captured by clapping a poison jar over the insects.

1Contribution from the Dept. of Zoology, University of Western Ontario; a project supported by funds from the government of Ontario on recommendation of the Advisory Committee on Fisheries and Wildlife of the Research Council of Ontario.

2Associate Professor of Zoology.

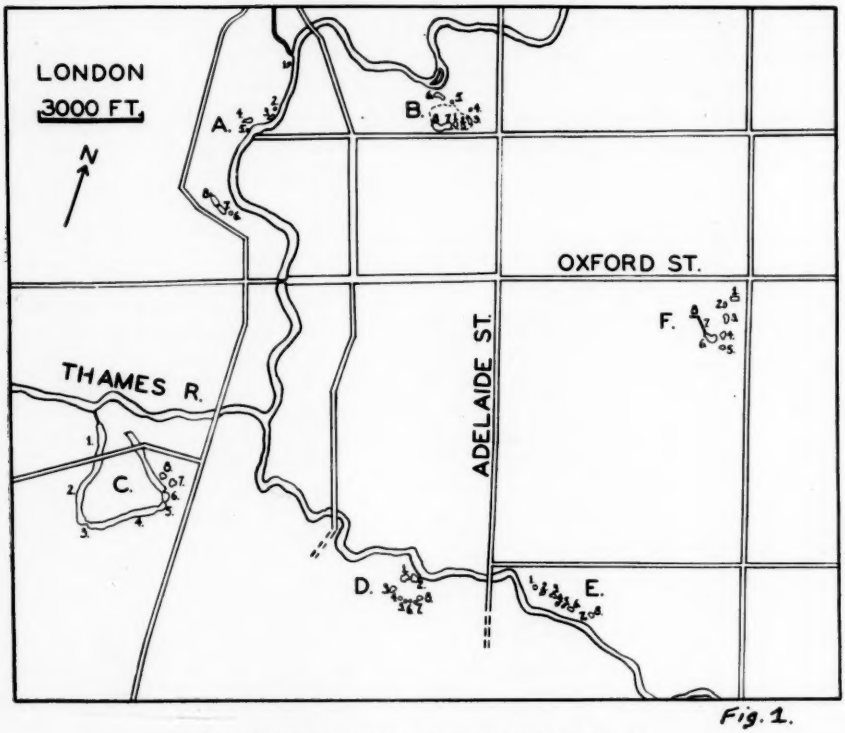


Fig. 1—Map of London showing location of pools.

The specimens were transferred to a poison jar and were later pinned and labelled with the date and locality of the collection. Adults were also collected at night in a light trap (Improved, Portable, New Jersey type, complete with timer and used with 110 volt, 60-cycle current and supplied by Concession Supply Co., Toledo, Ohio). This was placed in position at the side of a building adjacent to a copse of hardwood trees on the campus of the University of Western Ontario and was in operation from May 27 to September 15, 1952 and was timed to collect mosquitoes between 9:00 P.M. and 6:00 A.M., E.D.S.T. The nightly collections of adults were removed from the poison jar on the trap and were pinned for later identification.

Identifications of larvae and adults were made with the aid of keys in Matheson (1944) and Ross (1947), only third and fourth instar larvae being identified. The only pupae identified were those from which identifiable adults emerged.

Occurrence of Larvae and Pupae in Pools

Locality A (Fig. 1): Grounds of the University of Western Ontario and adjacent banks of the Thames River.

Pool A1—In grove of deciduous trees and fed by drainage system from slopes above; contained many small fish such as golden shiner (*Notemigonus crysoleucus*), common white sucker (*Cotostomus commersonii*) and common shiner (*Notropis cornutus*). No larvae or pupae were present.

Pool A2—(Fig. 4)—A shallow pool bordered by cat-tails; dried up by June 9.

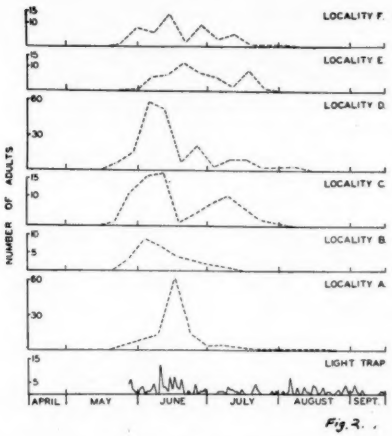


Fig. 2—Seasonal occurrence of adults at collection localities and in light trap.

In April and May it yielded larvae and pupae of *Aedes stimulans* and, in the first week of June, *A. trivittatus* and *A. vexans.*

Pool A3—(Fig. 4)—Shallow pool in flats along the river, fed by drainage from a culvert. It contained running water till June 30 after which the water was still and *Culex pipiens* and *C. restuans* occurred throughout the summer.

Pool A4—Mud flat supporting a stand of cat-tail, flooded with shallow running water in spring and drying during the summer. No larvae or pupae were present.

Pool A5—Shallow pool in a depression among willows, fed by water from a drainage pipe and dry by June 9. No larvae or pupae were present.

Pool A6—(Fig. 4)—A broad, shallow pool in a grove of deciduous trees, dry by May 6. Larvae of *A. stimulans* appeared in April.

Pool A7—(Fig. 4)—A long, deep pool in a trough of land beneath willows with rank growth of herbaceous plants in summer; dried by June 23. In April and the first part of May it contained *A. stimulans* and *A. fitchii,* in May *Culiseta inornata* and in June *Anopheles quadrimaculatus.*

Pool A8—(Fig. 4)—A westward extension of A7, dried by June 9. In April it yielded *A. stimulans,* in May *A. stimulans, A. fitchii* and *C. inornata.*

Locality B (Fig. 1): Pools around the borders of a cat-tail marsh flooded by water from a drainage ditch. During June the water slowly ceased to flow and drying occurred in July. Only two pools contained larvae and pupae. Pool B5, in a shallow depression containing sedges, contained *A. fitchii* in April and May (Fig. 4) and dried up by June 24. Pool B7, an area of flooded marsh, dried up by June 17 but larvae of *A. vexans* occurred in rain pools on June 30 (Fig. 4).

Locality C (Fig. 1): "The Coves", a long deep backwater of the Thames River, bordered by cat-tail in some places, but its main expanse without vegetation. The three pools adjacent to the river, C1, C2, C3, contained fish such as carp (*Cyprinus carpio*) and goldfish (*Carassius auratus*) and other smaller fish, and yielded no larvae or pupae. Pools C4 and C5 contained *C. pipiens* among vegetation at their borders in June (Fig. 4). Pool C6, a still, shallow pool surrounded by cat-tail and littered with refuse, contained *C. pipiens* throughout the summer and *A. quadrimaculatus* in July (Fig. 5). Pools C7 and C8, separated from the other pools, were filled with flood water in the spring and dried up by

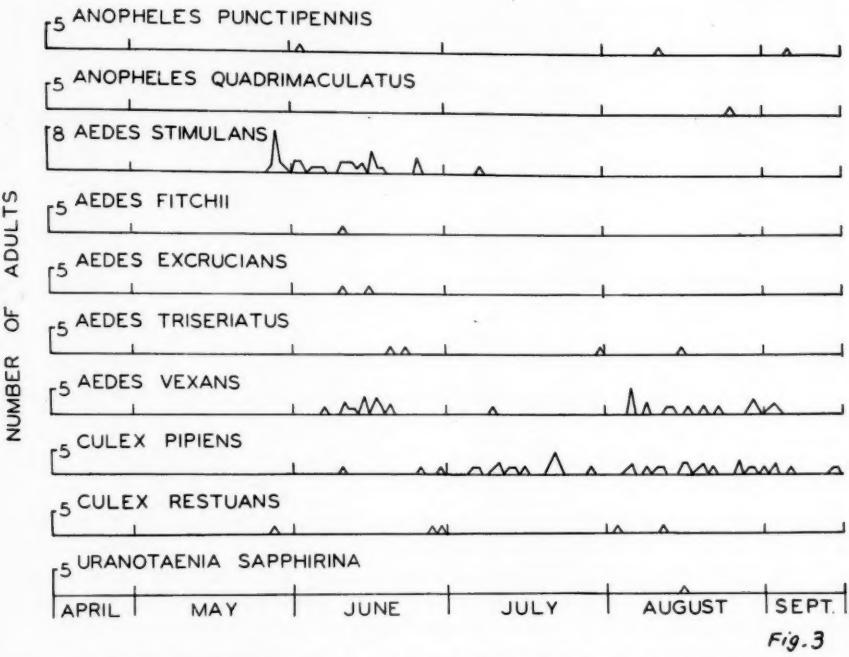


Fig. 3—Seasonal occurrence of the species of adults taken in the light trap.

June 18. In April and the first half of May they yielded *A. stimulans*, *A. fitchii* and *A. cinereus* and in the latter half of May *A. vexans* (Fig. 5).

Locality D (Fig. 1): Eight pools surrounding a city dump. Pools D1 and D2 contained a dense growth of cat-tail, and sedges and smartweed (*Polygonum amphibium*). No larvae or pupae appeared in D1 but D2 contained *C. pipiens* and *C. apicalis* after the middle of June (Fig. 5). Pool D3 was overgrown with sedges and canary grass (*Phalaris arundinacea*) and during July contained *C. pipiens* and *C. apicalis* (Fig. 5). Pools D4 to D8 were temporary pools in hollows beneath willows and dried up in June and July after yielding *A. stimulans*, *A. fitchii* and *A. vexans* in April, May and June (Fig. 5).

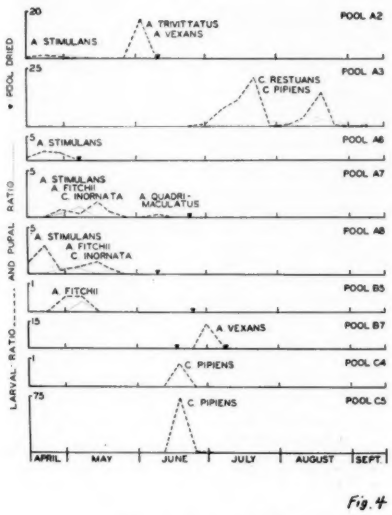
Locality E (Fig. 1): Pools in a trough of land between a city dump and flats along the Thames River.

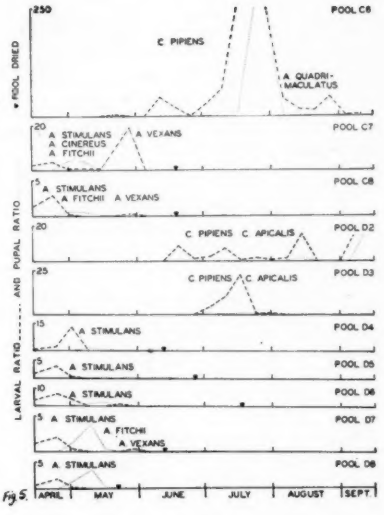
Pool E1—A shallow pool containing sedges produced *A. stimulans* and *C. inornata* before drying up in June (Fig. 6). During the rest of the summer rainwater provided breeding pools for *C. pipiens* and *A. vexans*. Pool E2— a shallow pool beneath willows contained *A. stimulans* before drying up in June (Fig. 6).

Pool E3—A deep pool among cat-tails and with its surface covered with duckweed (*Lemna minor*) contained *C. apicalis* and *A. punctipennis* in July and August (Fig. 6).

Pool E5—A shallow depression beneath willows yielded *A. stimulans* before drying up in the first week of May (Fig. 6).

Pool E7—A mud-flat, fed by a spring and occupied by cat-tail, contained *A. vexans*, *C. apicalis*, *C. pipiens* and *C. restuans* in July (Fig. 6).





Figs. 4 and 5—Seasonal occurrence of larvae and pupae in pools.

Pool E8—A small pool choked with cat-tail and covered with duckweed (*Lemma minor*) yielded *C. apicalis*, *C. pipiens* and *A. punctipennis* during the summer (Fig. 6).

Pools E4 and E6, flooded areas among willows and occupied by sedges, contained no larvae or pupae.

Locality F (Fig. 1): A series of pools and drainage ditches along a valley.

Pool F1—A large cement-lined reservoir was filled with water during April but was drained in the first week of May leaving small pools which contained *C. pipiens* and *A. vexans* in June (Fig. 6).

Pool F3—A mud flat supporting a heavy growth of cat-tail yielded larvae of *Aedes canadensis* before drying up in June (Fig. 6).

Pool F6—A broad, shallow pool in a meadow contained *A. vexans* and *C. pipiens* (Fig. 6) before drying up in September.

Pool F7—A drainage ditch dried up by August into a series of small pools which yielded *C. pipiens* and *A. vexans* during August (Fig. 6).

Pools F2, F4 and F5 which were shallow flats covered with running water, and Pool F8, a westward extension of F7, contained no larvae or pupae.

Occurrence of Adults

During the period of collection 624 adults were taken, 468 in flight at the pools and 156 in the light trap. The seasonal abundance of adults is represented in Fig. 2. The first adults appeared in flight in the middle of May and the peak of abundance occurred in the middle of June, the population gradually decreasing during July and August and a few adults being taken in September. The relative abundance of the thirteen species caught in the trap and in flight at the pools is shown in Table I and the times of occurrence and numbers of the ten species caught in the trap are indicated in Fig. 3.

Account of species collected

Anopheles punctipennis (Say)

Adults: in trap on June 2, Aug. 11, Sept. 5 (Figs. 3, 7).

Larvae: in pools E3 and E8 only, between July 25 and Aug. 27 (Fig. 7), the

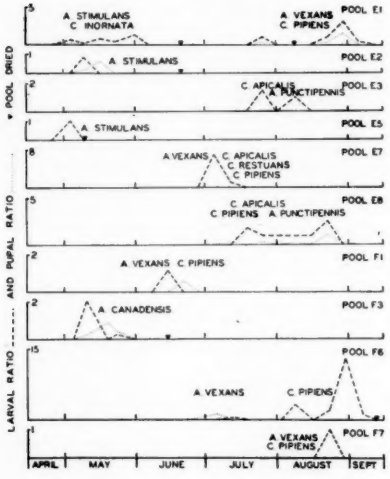


Fig. 6.

Fig. 6—Seasonal occurrence of larvae and pupae in pools.

pools at that time supporting a dense growth of cat-tail (*Typha latifolia*) and with the surface covered with duckweed (*Lemna minor*).

Anopheles walkeri Theobald

Adult: a single female in flight, locality B, June 3.

Anopheles quadrimaculatus Say

Adult: one female, light trap, Aug. 25 (Fig. 3).

Larvae: found only in Pool A7, June 9, one week before the pool dried up (Fig. 4) and in Pool C6, July 30, in company with multitudes of *C. pipiens* (Fig. 5).

Aedes stimulans (Walker)

Adults: May 21-Aug. 18; maximum, June 17 (Fig. 7); the most abundant species (Table I).

Larvae and pupae: April 21-May 16 (Fig. 7). They occurred in several pools particularly those which were formed by melting snow and spring run-off in hollows in meadows and beneath the growth of willow in low ground and which dried rapidly in May and June.

TABLE I

Adults taken in flight and in the light trap

	♂	♀	Total
Anopheles punctipennis	0	3	3
Anopheles walkeri	0	1	1
Anopheles quadrimaculatus	0	1	1
Aedes cinereus	0	1	1
Aedes excrucians	0	5	5
Aedes fitchii	2	127	129
Aedes stimulans	37	338	375
Aedes vexans	17	35	52
Aedes triseriatus	2	3	5
Culex pipiens	12	33	45
Culex restuans	1	4	5
Mansonia perturbans	0	1	1
Uranotaenia sapphirina	0	1	1

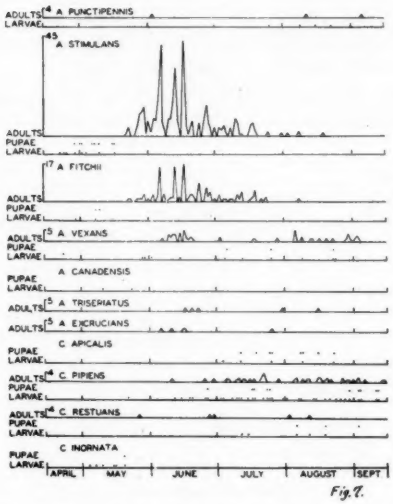


Fig. 7—Times of occurrence of larvae and pupae in pools and seasonal occurrence of adults of each species.

Aedes fitchii (Felt and Young)

Adults: May 22-Aug. 7; maximum, June 17 (Fig. 7); second in abundance to *A. stimulans*.

Larvae and pupae: Apr. 28-May 16 (Fig. 7). They occurred commonly in pools with *A. stimulans*, appearing first a week later than *A. stimulans*.

Aedes vexans (Meigen)

Adults: June 6-Sept. 2; maximum, June 16, Aug. 5 (Figs. 3, 7).

Larvae and pupae: May 28-Aug. 23 (Fig. 7). They first appeared in pools occupied by *A. stimulans* and *A. fitchii* but later than these species. Throughout the summer they were found in company with *C. pipiens*, *C. restuans* and *C. apicalis* in shallow pools.

Aedes canadensis (Theobald)

Larvae and pupae: May 10-May 23 (Fig. 7). This species was found only in Pool F3 (Fig. 6).

Aedes triseriatus (Say)

Adults: five adults, one on June 16, locality A; four in light trap, June 19, 22, July 30, Aug. 15 (Figs. 3, 7).

Aedes trivittatus (Coquillett)

Larva: Pool A2, June 2 in company with larvae of *A. vexans*.

Aedes cinereus Meigen

Adult: one female, locality D, June 12.

Larva: Pool C7, Apr. 30, with *A. stimulans* and *A. fitchii*.

Aedes excrucians (Walker)

Adults: Two in light trap, June 10, 15 (Fig. 3); one, June 5, locality D; one, June 16, locality A; one, locality E, July 25 (Fig. 7).

Culex apicalis Adams.

Larvae and pupae: July 3-Aug. 22 (Fig. 7). This species occurred commonly with *C. pipiens* during late summer in permanent pools in Localities D and E.

Culex pipiens L.

Adults: June 10-Sept. 14 (Figs. 3, 7). This was one of the more abundant species (Table 1) after the middle of June.

Larvae and pupae: May 21- Sept. 11. This species was prevalent in permanent pools in all localities and was present in enormous numbers in some pools, e.g. C6.

Culex restuans Theobald

Adults: May 26-Aug. 11 (Figs. 3, 7).

Larvae and pupae: July 11-Sept. 2 (Fig. 7); occurred with *C. pipiens* in permanent pools.

Culiseta inornata (Williston)

Larvae and pupae: May 3-May 19 (Fig. 7); occurred in pools with *A. stimulans* and *A. fitchii*, but first appeared later than these two species.

Mansonia perturbans (Walker)

Adult: one female in flight, locality D, June 19.

Uranotaenia sapphirina (Osten Sacken)

Adult: one female, light trap, Aug. 15.

Acknowledgment

The writer gratefully acknowledges the assistance of Mr. E. A. Belle who aided throughout the summer of 1952 in collecting samples at the pools, rearing larvae and pupae and counting samples of specimens.

Literature Cited

Freeman, T. N. 1952. Some problems of insect biology in the Canadian Arctic. *Arctic*, 5: 175-177.

Hearle, E. 1926. The mosquitoes of the lower Fraser valley, British Columbia, and their control. Canada, National Research Council, Report No. 17.

Judd, W. W. 1950. Mosquitoes collected in the vicinity of Hamilton, Ontario during the summer of 1948. *Mosquito News*, 10: 57-59.

Matheson, R. 1944. Handbook of the mosquitoes of North America. Comstock Publ. Company, Ithaca.

McLintock, J. 1944. The mosquitoes of the greater Winnipeg area. *Can. Entomol.*, 76: 89-104.

Ross, H. H. 1947. The mosquitoes of Illinois. *Bull. Illinois Nat. Hist. Surv.*, Vol. 24, article 1.

Twinn, C. R. 1944. Report on the 1944 Anopheline mosquito survey in Canada. Canada Dept. of Agric., Entomol. Div., Processed Publ. No. 17.

Twinn, C. R. 1950. Studies on the biology and control of biting flies in northern Canada. *Arctic*, 3: 14-26.

Twinn, C. R. 1952. A review of studies of blood-sucking flies in northern Canada. *Can. Entomol.*, 84: 22-28.

Urquhart, F. A. 1948. A survey of the mosquitoes of the Toronto region. Allied Printing Co., Toronto.

Notes on Northern Species of *Aedes*, with Descriptions of Two New Species (Diptera: Culicidae)[1]

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Examination of the types of some species of *Aedes* has shown that a number of them have been misidentified by later workers. Certain changes of names are unfortunately necessary; these are indicated below. Notes on a few types not involved in this synonymy are included. Descriptions of two new species are also given—one of these has been frequently recorded and described in the literature under the name *Aedes impiger* (Walk.); the other has not previously been described.

Aedes impiger (Walker)

Culex impiger Walker, 1848, *List Dipt. Brit. Mus.* 1: 6.
Aedes nearcticus Dyar, 1919 (*partim*), *Rept. Canadian Arctic Exped.* 3, C: 32. *New synonymy.*
Aedes (*Heteronycha*) *nearcticus*, Dyar, 1921 (*partim*), *Trans. Roy. Canadian Inst.* 13: 111.
Aedes (*Ochlerotatus*) *parvulus* Edwards, 1922, *Bull. Ent. Res.* 3: 314. *New synonymy.*
Aedes nearcticus, Dyar, 1922, *Ins. Ins. Mens.* 10: 74.
Aedes (*Heteronycha*) *nearcticus*, Dyar, 1922, *Proc. U.S.N.M.* 62, art. 1, p. 84.
Aedes alpinus (L.), Twinn, 1927 (*partim*), *Canadian Ent.* 59: 47.
Aedes (*Ochlerotatus*) *nearcticus*, Hearle, 1927, *Canadian Ent.* 59: 61.
Aedes (*Ochlerotatus*) *nearcticus*, Dyar, 1928, *Carnegie Inst. Washington, Pub.* 387, p. 196.
Aedes nearcticus, Natvig, 1928, *Norsk Ent. Tidsk.* 2: 246.
Aedes nearcticus, Matheson, 1929, Handbook of the mosquitoes of North America, p. 144. Charles C. Thomas, Springfield, Ill., Baltimore, Md.
Aedes nearcticus, Martini, 1931 (*partim*), *in* Lindner, *Die Fliegen der Pälaearktischen Region*, Vols. 11, 12: 309.
Aedes nigripes (Zett.), Martini, 1931 (*partim*), *in* Lindner, *Die Fliegen der Pälaearktischen Region*, Vols. 11, 12: 310.
Aedes parvulus, Martini, 1931, *in* Lindner, *Die Fliegen der Pälaearktischen Region*, Vols. 11, 12: 315.
Aedes (*Ochlerotatus*) *nearcticus*, Matheson, 1944, Handbook of the mosquitoes of North America, 2nd ed., p. 174. Comstock Publ. Co., Ithaca, N.Y.
Aedes (*Ochlerotatus*) *nearcticus*, Gjullin, 1946, *Proc. Ent. Soc .Washington* 48: 215.
Aedes (*Ochlerotatus*) *nearcticus*, Natvig, 1948, *Norsk Ent. Tidsk.*, Suppl. 1: 311.
Aedes nearcticus, Rempel, 1950, *Canadian J. Res.*, D, 28: 225.

The type female of *Culex impiger* Walker is a specimen of the species described by Dyar as *Aedes nearcticus*. The tarsal claw is sharply bent immediately beyond the tooth, the postpronotum has setae scattered over most of its surface, and the costa is entirely dark-scaled. *Aedes impiger*, Dyar, 1920, *et auct.* (*non* Walker, 1848), has the tarsal claw short and only slightly bent beyond the tooth, the postpronotum with a single row of setae along the posterior margin, and the costa with a small patch of white scales near the base.

The type specimen of *impiger* was collected at St. Martin's Falls, Albany River, Hudson's Bay. This is farther south than any other locality at which the species has been taken in Eastern Canada, but it occurs at Yellowknife and Ft. Smith, N.W.T., and at Gillam, Man., all far south of the Arctic region (the normal habitat of *impiger*); therefore its occurrence at St. Martin's Falls is not incredible.

Dyar described *Aedes nearcticus* from a long series of specimens from Arctic North America. Only two of these, a female (No. 1395) and a male (No. 1391), were definitely designated as types. Many of the other specimens are not conspecific with these two syntypes, but are specimens of *Aedes nigripes* Zett. Curran (1927) referred to the male syntype as the holotype but did not definitely

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2Agricultural Research Officer.

designate it as the lectotype. This male (Bernard Harbour, N.W.T., July 19, 1915, F. Johannsen, No. 1391) is hereby designated as the lectotype of *Aedes nearcticus* Dyar (Type No. 1877 in the Canadian National Collection).

***Aedes (Ochlerotatus) implicatus* n.sp.**

Aedes decticus, Howard, Dyar and Knab, Dyar, 1919 (*partim*), *Ins. Ins. Mens.* 7: 21.
Aedes impiger. Dyar, 1920 (*non* Walker, 1848), *Ins. Ins. Mens.* 8: 8.
Aedes (*Heteronycha*) *impiger*, Dyar, 1921 (*non* Walker), *Trans. Roy. Canadian Inst.* 13: 100.
Aedes (*Heteronycha*) *impiger*, Dyar, 1922 (*non* Walker), *Proc. U.S.N.M.* 62, art 1, p. 63.
Aedes impiger, Matheson, 1929 (*non* Walker), Handbook of the mosquitoes of North America, p. 126. Charles C. Thomas, Springfield, Ill., Baltimore, Md.
Aedes (*Ochlerotatus*) *impiger*, Matheson, 1944 (*non* Walker), Handbook of the mosquitoes of North America, 2nd ed., p. 169. Comstock Pub. Co., Ithaca, N.Y.
Aedes (*Ochlerotatus*) *impiger*, Gjullin, 1946 (*non* Walker), *Proc. Ent. Soc. Washington* 48: 232.
Aedes impiger, Rempel, 1950 (*non* Walker), *Canadian J. Res.*, D, 28: 218.

As indicated above, the type of *Culex impiger* Walk, is a specimen of the species known, in North America and in Europe, as *Aedes nearcticus* Dyar. The name *impiger* has been consistently misapplied. In searching for a name that could be used for *impiger* sensu Dyar, 1920, I examined pertinent types of North American species in the U.S.N.M., including that of *Aedes decticus* H., D., & K. (which is a specimen either of *Aedes diantaeus* H., D., & K. or of *A. pseudodiantaeus* Smith). None of these was identical with the present form, which I, therefore, recognize as a new species. Adequate decriptions and figures of the larval and adult stages being already available in the literature, I give here only the more important diagnostic characters.

Larva.—Antenna short, about half as long as head, spined; tuft of 3-5 hairs inserted before middle and reaching to end of antenna; apex with one long and several short setae. Upper and lower head hairs single. Formula for first seven prothoracic hairs usually 1, 1, 1; 1; 2, 1, 3. Hair 1 long, moderately stout; 2 finer, three-quarters as long as 1; 3 finer still, half as long as 2. Lateral abdominal hairs double on segments 1-5, single on 6 and 7. Eighth segment with about 24 comb scales in a triangular patch; single scale broad, with a number of lateral spinules and a slightly longer apical spine. Dorsal plate of anal segment incomplete ventrally, minutely spinose. Air tube about 2½ times as long as wide; pecten of evenly placed teeth, extending about two-fifths of the length of the tube; tuft with about six branches, at middle of tube. The larva is figured adequately by Rempel (1950, Fig. 14).

Female.—Wing 3.3-4.4 mm. Proboscis black. Mesonotum with silvery-grey scales; broad median stripe of pale-brown scales, expanded on anterior half of mesonotum almost to lateral margins, and with two indistinct, submedian lines of dark-brown scales separated by a median line of pale-brown scales. Posterior half-lines of pale brown scales present on either side of prescutellar area. Lower mesepimeral bristles present; hypostigial scale patch absent or of few to many scales; membranous area between fore coxa and sternopleurite with scales (post-coxal scale patch). Bristles of mesonotum and scutellum dark, sometimes with paler reflections. Abdominal tergites with narrow, regular, white basal bands. Femora, tibiae, and basitarsi with many scattered white scales anteriorly, mostly white-scaled posteriorly. Tarsal claw (Fig. 1) short; main claw extending only a short distance beyond tooth and turned up only slightly. Costa with a few pale scales at base above, wing otherwise dark-scaled.

Male.—Wing 3.7-4.4 mm. Colour as in female. Palpus longer than proboscis by about half length of terminal segment; terminal segment slender; antepenultimate segment black with scattered white scales. Claws of hind tarsi of same shape as those of female. Genitalia with basal lobe of basistyle small, broadly attached, regular in outline, its median margin with a row of bristles ending in a distinct,



Figs. 1-6. *Aedes rempeli* n.sp. 1. Terminal segments of abdomen of fourth-instar larva. 2. Comb-scale of larva. 3. Pecten-tooth of larva. 4. Genitalia of male. 5. Posterior view of basal lobe of basistyle. 6. Tarsal claw of female.

slightly curved spine on the dorsolateral corner. Apical lobe of basistyle distinct, long, thumb-like, almost bare on dorsal surface, sparsely haired on ventral surface. Basistyle with a small tuft of long bristles on dorsal surface just in front of base of apical lobe. Stem of claspette slender, elongate, bent just before middle, slightly enlarged before bend. Filament about three-fifths as long as stem, expanding rapidly beyond its base, then tapering gradually to the slightly recurved apex. The genitalia are figured by Matheson (1944, Pl. 15, Fig. 6), but the claspette filament in the specimens I have examined is merely sharply angled above, without a distinct spine.

Holotype.– ♂, with associated larval and pupal exuviae, Rupert House, Que., 1949 (D. P. Gray); Type No. 6031, Canadian National Collection.

Paratypes.–2 ♂ ♂, 8 ♀ ♀, all with associated larval and pupal exuviae, same data as holotype.

Specimens from Oliver and Fort Nelson, B.C., Dawson, Y.T., Norman Wells and Ft. Smith, N.W.T., Bever Creek, Sask., Gillam, Man., Ottawa, Arnprior, and

Moose Factory, Ont., and Chelsea and Hemmingford, Que., have also been examined, but are not designated as paratypes.

***Aedes (Ochlerotatus) rempeli* n.sp.**

Figs. 1-6

Aedes n.sp., Jenkins & Knight, 1950, *Proc. Ent. Soc. Washington* 52: 220.

Larva.—Head wider than long. Antenna about half as long as head, spined; antennal tuft inserted slightly before middle, multiple, reaching about halfway to apex of antenna. Apex of antenna with one long and three short bristles. Upper and lower head hairs single.

Thorax and abdomen smooth, not spicular-pilose. Prothoracic hair formula 1, 1, 1; 1; 3, 1, 3. Hairs 1, 5, 6, and 7 almost twice as long as head, hairs 2, 3, and 4 only slightly shorter than head.

Abdominal segments 1 to 3 with lateral hair double; segments 4 and 5 with hair double or single; segment 6 with lateral hair single. Eighth segment (Fig. 1) with a triangular patch of about 35 scales; single scale (Fig. 2) with a fringe of long spines, the apical one usually the longest. Respiratory siphon (Fig. 1) about four times as long as broad. Siphonal hair tuft multiple, inserted at middle of siphon, beyond the pecten. Pecten of evenly placed spines; single spine (Fig. 3) with one large and one or two small teeth; last few spines untoothed. Anal segment (Fig. 1) completely ringed by the saddle, as wide as long. Lateral saddle hair single, a little longer than the saddle; dorsal hair of the dorsal brush double or triple, 3½ to 5 times as long as the saddle; ventral hair of the dorsal brush single, almost 6 times as long as the saddle. Ventral brush with about 11 pairs of hair tufts, two of them in front of the barred area. Anal gills slender, tapering to a point, about 3 times as long as the anal segment.

Female.—Wing 5 mm. Proboscis black. Palpus black, wth a few white scales below at base of penultimate segment, about one-eighth as long as proboscis. Torus with dark integument; scales dark except for a few pale ones on inner posterior surface. Vertex with whitish scales; those on central half narrow, more or less upright, those on lateral margins broad, overlapping, and appressed. Front margin of vertex with two or three rows of long, erect, black setae; rest of vertex with shorter, erect, black setae that are slightly flattened at the tips.

Integument of mesonotum blackish-brown. Scales of mesonotum greyish-yellow, except for a submedian longitudinal line of dark-brown scales running back to the prescutellar area and extending almost to the margins of the mesonotum on its anterior half, and a poorly defined dorsolateral posterior half-line of dark-brown scales. The anterior end of the submedian line, the posterior end of the posterior half-line, and an area in front of the scutellum devoid of scales. Scutellum with long, slender, pale scales. Bristles of mesonotum and scutellum abundant, long, black with a bronze tint. Pronotal lobe with flat, rather broad, pale scales, black bristles above and pale bristles below; postpronotum with rather narrow white scales and a single posterior row of bronze-black bristles; propleuron, upper angles and posterior third of sternopleuron, and upper two-thirds of mesepimeron with broad whitish scales and pale bristles; paratergite, meteusternum, and lower margin of mesanepisternum with broad whitish scales. Hypostigial scale patch absent. Membranous area between the anterior coxa and sternopleurite devoid of scales. Lower mesepimeral bristles two or three in number.

Abdominal tergites black with basal white bands, these bands of even width on the anterior segments, slightly broader laterally on the posterior segments. Sternites with posterior corners white-scaled, otherwise black-scaled.

Coxae with flattened white scales and pale bristles. Fore and mid femora dark-scaled dorsally and anteriorly, white-scaled ventrally and posteriorly; hind

femur dark above, and along the sides apically, otherwise white-scaled. Knees pale. Tibiae dark with a few white scales anteriorly and many posteriorly. Tarsi dark; basitarsi with a few scattered white scales posteriorly. Tarsal claws each with one sub-basal tooth; single claw (Fig. 6) elongate, slender.

Wing with a few white scales at base of costa, scales otherwise dark and narrow.

Male.—Wing 4.5 mm. Colour similar to that of female. Palpus slightly longer than proboscis, apical segment slender. Scutellar hairs paler than in female, yellowish-bronze. Costa without white scales at base.

Genitalia (Fig. 4): Basistyle with basal and apical lobes. Basal lobe (Fig. 5) large, broadly attached, inner margin almost straight; dorsomedial angle rounded, ventromedial angle slightly produced; inner margin with long setae that decrease in length ventrally, without a distinct spine. Apical lobe small, almost bare, with a few very small setae at apex. Basistyle with short setae over most of surface, with long setae on dorsal and ventral surfaces. Dististyle inserted at apex of basistyle, slightly enlarged in basal third, then tapering to apex; apical spine of dististyle slender and tapering. Claspette long; stem slightly enlarged and bent just before middle, without distinct bristles; filament slightly shorter than the stem, flat, bladelike, upper surface gently curved, tip slightly deflexed. Lobe of ninth tergite with about 7 spines.

Holotype.—♂, with associated larval and pupal exuviae, Great Whale River, Que., June 23, 1949 (Knight and Jenkins). Type No. 6032, Canadian National Collection.

Paratypes.—1 ♂, 1 ♀ with associated larval and pupal exuviae, Padley, N.W.T., July 30, 1950 (R. A. Hennigar).

The species is named after Dr. J. G. Rempel, University of Saskatchewan, who has done much to make known the mosquitoes of Western Canada.

Jenkins and Knight (1950) suggested that *Aedes rempeli* is related to the *trivittatus* group. The larva is similar to that of *trivittatus* (Coq.), but the characters of the adults indicate that it belongs to Edwards' Group G of the subgenus *Ochlerotatus* whereas *trivittatus* is placed by Edwards in Group F. (Edwards, 1932). Knight (1951) has reviewed the characters of Groups F and G. *Aedes rempeli* has scales on the paratergite and meteusternum of the female, lacks the pale-scaled areas on the mesonotum of both sexes, and has the male claspette filament elongate, slender, and bladelike, without a retrorse spine; it thus definitely belongs in Group G. Within this group, however, its position is not clear. Except *nigripes*, all North American species of Group G with the anal segment of the larva completely ringed are in the *punctor* subgroup [as defined by Knight (1951)]. However, *rempeli* lacks the strong spine of the basal lobe of the basistyle and the flattened, clinging setae of the apical lobe, both of which are characters of the *punctor* subgroup. The species is perhaps related most closely to *nigripes*, which also lacks the distinct spine on the basal lobe, but the adults of *rempeli* are markedly less hairy than those of *nigripes*.

The larva of *rempeli* keys to *trivittatus* in the key to larvae given by Matheson (1944) but has a longer, more slender siphon, with the pecten not reaching the middle, and the dorsal hair of the dorsal brush of the anal segment is long and two- or three-branched, instead of short and multiple. The male keys to couplet 31 [*alpinus* auct. (*non* L.) (=*nigripes* Zett.) and *bimaculatus* (Coq.)] but differs from these species in the shape of the basal lobe of the basistyle. The female keys to couplet 52 in Gjullin's key to females of *Aedes* (Gjullin, 1946), but of the four species included [*hexodontus* Dyar, *communis* (Deg.), *impiger* auct. (*non* Walk.) (=*implicatus* Vock.), and *pionips* Dyar] only

implicatus has the median stripe expanded on the anterior half of the mesonotum, and *implicatus* has a patch of post-coxal scales, which is lacking in *rempeli*.

Jenkins and Knight (1950) gave the following note on the habitat of the single larva of *A. rempeli* found at Great Whale River: "The larval habitat was an unshaded rock crevice pool on a slope facing north at an elevation of 500 ft. The pool was 3 ft. wide by 10 ft. long and about 1 ft. in depth. The sides were bare granite rock and on the bottom were dead grass and sedge. The larva was collected on 17 June and the adult emerged on 23 June . . . The larva was associated in the same pool with *A. nearcticus* and *A. communis*."

Both the Padley specimens were reared from larvae found in a large, apparently permanent pool, about 45 feet by 30 feet by 18 inches, the bottom mostly bare rock with only a few clumps of grass. One hundred and five specimens of *A. communis*, 38 of *A. nigripes*, and 1 of *A. impiger* [=*nearcticus* Dyar] were reared from larvae and pupae from this pool. A total of 1161 specimens of *Aedes* spp. were reared in the Padley area during the summer of 1950, a sufficient indication of the rarity of *A. rempeli*.

Aedes punctor (Kirby)

Culex punctor Kirby, 1837, *in* Richardson, *Fauna Boreali-Americana* 4: 309.
Culex implacabilis Walker, 1848, *List. Dipt. Brit. Mus.* 1: 7. *New synonymy.*
Culex punctor, Theobald, 1901, *Monogr. Culicid.* 2: 75. Brit. Mus. (Nat. Hist.), London.
Aedes (*Ochlerotatus*) *punctor*, Matheson, 1944, Handbook of the mosquitoes of North America, 2nd ed., p. 178. Comstock Publ. Co., Ithaca, N.Y.

The name *punctor* Kirby is here based on the so-called types that were redescribed by Theobald in 1901. These "types" were from St. Martin's Falls, Albany River, and were presumably the specimens listed by Walker (1848) under this name, whereas Kirby's specimens (the true types) were from the Mackenzie River valley near Fort Norman, N.W.T. (Lat. 65°). The true types of *punctor* being lost, it seems best to accept the oldest authoritative interpretation of the species.

I have examined the single type female of *implacabilis* in the British Museum (Natural History). The mesonotum is pierced by a large pin, but a dark-brown median longitudinal stripe is visible. The sides of the mesonotum are bronzy; the marginal bristles are golden-bronze. Lower mesepimeral bristles are present. The costa is entirely dark-scaled. A basal pale band is present on at least the third tergite. The legs are all missing.

This specimen is undoubtedly one of *punctor* Kirby; all females of *implacabilis* auct. (*non* Walker) that I have examined have the mesonotum uniformly brown-scaled, with the median longitudinal stripe indicated only by finer scales.

Aedes abserratus (Felt and Young)

Culex abserratus F. & Y., 1904, *Science*, n.s., 30: 312.
Culex abserratus, Felt, 1904, *New York State Mus. Bull.* 79: 329.
Culicida abserratus, Felt, 1905, *New York State Mus. Bull.* 97: 447.
Culex punctor, Smith, 1905 (*non* Kirby, 1837), *New Jersey Agr. Expt. Sta. Rept.*, p. 681.
Aedes punctor, Dyar, 1906 (*non* Kirby), *J. New York Ent. Soc.* 14: 194.
Ochlerotatus punctor, Dyar, 1906 (*non* Kirby), *U.S. Dept. Agr., Bur. Ent., Circ.* 72: 4.
Culex punctor, Grossbeck 1906 (*non* Kirby), *New Jersey Agr. Coll. Expt. Sta. Rept.*, p. 666.
Ochlerotatus abserratus, Mitchell, 1907, Mosquito Life, p. 261. Putnam, New York.
Culicada abserrata, Theobald, 1907, *Monogr. Culicid.* 4: 364. Brit. Mus. (Nat. Hist.), London.
Aedes (*Heteronycha*) *centrotus* Howard, Dyar, and Knab, 1917, *Carnegie Inst. Washington, Publ.* 159, 4: 747.
Aedes punctor, Dyar, 1919 *partim* (*non* Kirby), *Ins. Ins. Mens.* 7: 14.
Aedes (*Heteronycha*) *punctor*, Dyar, 1921 *partim* (*non* Kirby), *Trans. Roy. Canadian Inst.* 13: 95.
Aedes (*Ochlerotatus*) *dysanor* Dyar, 1921, *Ins. Ins. Mens.* 9: 70.
Aedes (*Heteronycha*) *punctor*, Dyar, 1922 *partim* (*non* Kirby), *Proc. U.S.N.M.* 62, art. 1, p. 56.
Aedes (*Heteronycha*) *dysanor*, Dyar, 1922, *Proc. U.S.N.M.* 62, art. 1, p. 56.

Aedes abserratus, Matheson, 1924, *Ins. Ins. Mens.* 12: 24.
Aedes implacabilis, Dyar, 1924 (*non* Walker), *Ins. Ins. Mens.* 12: 26.
Aedes (*Ochlerotatus*) *implacabilis*, Dyar, 1928 (*non* Walker), *Carnegie Inst. Washington, Pub.* 387, p. 186.
Aedes abserratus, Matheson, 1929, Handbook of the mosquitoes of North America, p. 122. Charles C. Thomas, Springfield, Ill., Baltimore, Md.
Aedes (*Ochlerotatus*) *implacabilis*, Matheson, 1944 (*non* Walker), Handbook of the mosquitoes of North Americiaii, 2nd ed., p. 170. Comstock Publ. Co., Ithaca, N.Y.
Aedes (*Ochlerotatus*) *implacabilis*, Gjullin, 1946 (*non* Walker), *Proc. Ent. Soc. Washington* 48: 288.
Aedes (*Ochlerotatus*) *implacabilis*, Ross, 1947 (*non* Walker), *Bull. Illinois Nat. Hist. Surv.* 24, art. 1, p. 81.
Aedes (*Ochlerotatus*) *implacabilis*, Knight, 1951 (*non* Walker), *Ann. Ent. Soc. Am.* 44: 98.
Aedes (*Ochlerotatus*) *implacabilis*, Darsie, 1951 (*non* Walker), *Cornell Univ. Agr. Expt. Sta. Mem.* 304: 23.

As indicated above, the type of *Culex implacabilis* Walker, 1848, is a specimen of *Aedes punctor* (Kirby, 1837). The correct specific name for *Aedes implacabilis*, Dyar, 1924, *et auct.* (*non* Walker) is thus *abserratus* (Felt and Young, 1904).

Aedes pullatus (Coquillett)

Culex pullatus Coq., 1904, *Proc. Ent. Soc. Washington* 6: 168.
Aedes pearyi Dyar & Shannon, 1925, *J. Washington Acad. Sci.* 15: 78. *New synonymy.*

The type female of *A. pearyi* D. & S. is a specimen of *Aedes pullatus* (Coq.), not of *cataphylla* Dyar as stated by Gjullin (1946).

Aedes hexodontus Dyar

Aedes hexodontus Dyar, 1916, *Ins. Ins. Mens.* 4: 83.
Aedes labradoriensis Dyar & Shannon, 1925, *J. Washington Acad. Sci.* 15: 78. *New synonymy.*

The type female of *A. labradoriensis* D. & S. is a specimen of *Aedes hexodontus* Dyar, not of *nigripes* (Zett.) as stated by Gjullin (1946).

Aedes excrucians (Walker)

Culex excrucians Walker, 1856, *Ins. Saund.*, p. 429.

The type female is in very poor condition; it is recognizable only as of *Aedes*, possibly one of the banded-legged species.

Aedes stimulans (Walker)

Culex stimulans Walker, 1848, *List Dipt. Brit. Mus.* 1: 4.

The type female is badly broken and rubbed; only the thorax, the base of one wing, the head (minus antennae and most of proboscis), and one fore leg to end of basitarsus remain. It is recognizable only as of a species of *Aedes*.

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References

Curran, C. H. 1927. *In* Notes on the occurrence of *Aedes* (*Ochlerotatus*) *nearcticus* Dyar in the Rocky Mountains Park, Alberta. (Culicidae Dipt.), by E. Hearle. *Canadian Ent.* 59, p. 62 (footnote).

Edwards, F. W. 1932. Diptera. Fam. Culicidae. *In* Genera insectorum, ed. by P. Wytsman, Fasc. 194. L. Desmet-Verteneuil, Bruxelles.

Gjullin, O. M. 1946. A key to the *Aedes* females of America north of Mexico (Diptera, Culicidae). *Proc. Ent. Soc. Washington* 48: 215-236.
Knight, K. L. 1951. The *Aedes* (*Ochlerotatus*) *punctor* subgroup in North America (Diptera, Culicidae). *Ann. Ent. Soc. Am.* 44: 87-99.
Matheson, R. 1944. Handbook of the mosquitoes of North America. 2nd ed. Comstock Publishing Co., Ithaca, N.Y.

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Notes on the Genus *Foersteria* Szépl. and a Redescription of *Foersteria laeviuscula* Szépl. (Hymenoptera: Braconidae)[1]

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In preparing a revision of the triaspidine genera which occur in North America, the author has considered all the genera of this group from the world, and has found some shifting of species necessary. The genus *Foersteria* was created in 1896 by Szépligeti for the reception of two new species described from Europe. At that time, both the genus and the two included species were rather inadequately characterized. This situation has continued to the present day and several authors have incorrectly placed several new species from other zoogeographical regions in this genus. This paper is an attempt to clarify the concept of Szépligeti's genus, and gives a redescription of *F. laeviuscula* Szépl.

This study was suggested by the receipt of a single female specimen of *Foersteria laeviuscula* Szépl., in a loan of specimens from the United States National Museum in 1950. This specimen had been collected in Hungary by Mr. C. F. W. Muesebeck of the U.S. National Museum, while he was in Europe in 1926. At that time, Mr. Muesebeck took the opportunity of comparing this specimen with the holotype female, which is deposited in the Hungarian National Museum at Budapest.

It is most unfortunate that a specimen of the genotype (*F. flavipes* Szépl.) is not available for study. The author is most grateful to Mr. Muesebeck for permission to use his specimen as a basis for the redescription.

Foersteria Szépligeti

Szépligeti, 1896, Wien. Ent. Zeit. 15: 148.—Szépligeti, 1896, Termes. Füzetek 19: 301.—Dalla Torre, 1898, Catalogus Hymen. 4: 209.—Ashmead, 1900, Proc. U.S. Nat. Mus. 23: 125.—Szépligeti, 1901, Potfuz. Termes. Kozl. 33: 288.—Szépligeti, 1904, Math. Natur. Ber. Ungarn 19 (1901): 197, 203.—Szépligeti, 1904, Genera Insect. Fasc. 22: 93.—Cameron, 1904, Invert. Pacif. 1: 48.—Niezabitowski, 1910, Spraw. Kom. fizyogr. Krakow 44: 70.—Cameron, 1911, Ann. Transv. Mus. 2: 204.—Viereck, 1914, U.S. Nat. Mus. Bull. 83: 60.—Brues, 1926, Proc. Amer. Acad. Arts Sci. 61: 396.—Fahringer, 1934, Opusc. Bracon. 3: 365.—Telenga, 1941, Fauna de l'U.R.S.S. 5(3): 369.—De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-35) Fasc. 53: 229.

GENOTYPE: *Foersteria flavipes* Szépligeti (by subsequent designation of Viereck, 1914, U.S. Nat. Mus. Bull. 83: 60).

According to the original description of the genus and of the two originally included species, and also to Mr. Muesebeck (in litt.), the two species described by Szépligeti are congeneric.

The genus rightly belongs in the *Blacus-Triaspis* complex, and appears to be closely related to *Calyptus* Haliday. It may be readily distinguished from *Calyptus* by the structure of the abdomen, which is composed solely of three tergites, whereas in *Calyptus* narrow apical rings of the more caudal segments

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are frequently visible. Furthermore, the second and third tergites are rounded laterally, continuous with the pleural areas, almost touching ventrally in the specimen examined, and with no sharp dividing ridge except for a short distance at the base of the second tergite.

Generic Features.—Length about 5 mm., including the ovipositor with its sheath. Usually black in colour with some parts brownish or testaceous, particularly the legs. Wings hyaline with the stigma and other veins brownish.

Head more or less rectangular in outline when viewed anteriorly; general surface varying from smooth and nitidous to roughly punctate and dull. Fronto-clypeal groove impressed, with an anterior tentorial pit at each end. Antennal sockets separated by some distance; antennae 27- or 28-segmented. Ocelli moderately large and circular. Occipital carina complete.

Thorax rather deep-set, more or less impunctate. Pronotum slightly extended; notauli impressed in *F. laeviuscula* Szépl. but evidently destroyed by the pin in the holotype of the genotype; scutellar groove impressed, the scutellum triangular; propodeum moderately carinate; meso-pleura without grooves. Hind wing with the nervellus and the second abscissa of the mediella subequal. Legs of moderate length and the hind coxae not armed.

Abdomen elongate, with a dorsal carapace composed of three tergites. The basal tergite wider at apex than long, with a distinct lateral margin and with the first tranverse suture deeply impressed. Second and third tergites fused, the second being longer than the third and the second transverse suture a mere line; second and third tergites rounded laterally and continuous with the pleural region, with no sharp tergo-pleural demarcation except at the base of the second tergite. General surface smooth and shiny; first tergite slightly rugose, and apex of third tergite with concentric, crescentic ridges or roughly reticulate. Apical margin entire, not notched Ovipositor and sheath longer than the abdominal carapace and slender.

Biology.—Nothing is known concerning the life-history and habits of the component species of this genus.

Distribution.—Members of this genus are recorded from the Palaearctic, Neotropical, and Ethiopian regions. But the species recorded from the two regions other than the Palaearctic do not belong in this genus. They were placed in it because of the lack of information concerning the generic characters. At present, two species comprise this genus, namely, *F. flavipes* Szépl. and *F. laeviuscula* Szépl.

***Foersteria flavipes* Szépligeti**

Szépligeti, 1896, Wien. Ent. Zeit. 15: 148, (♀; Budapest).—Szépligeti, 1896, Termes, Füzetek. 19: 301.—Dalla Torre, 1898, Catalogus Hymen. 4: 209.—Szépligeti, 1901. Potfuz. Termes. 33: 288 [in key to species].—Szépligeti, 1904, Math. Natur. Ber. Ungarn 19 (1901): 203.—Szépligeti, 1904, Genera Insect. Fasc. 22: 92 (Hungary).—Niezabitowski, 1910, Spraw. Kom. fizyogr. Krakow 44: 70.—Viereck, 1914, U.S. Nat. Mus. Bull. 83: 60, [listed as genotype].—Fahringer, 1934, Opusc. Bracon. 3: 366 (bibliography).—Telenga, 1941, Faune de l'U.R.S.S. 5(3): 369 (fig. 129, description of ♂,♀).

This form was evidently described from a single female specimen collected from the Budapest region. Niezabitowski, in 1910, mentions a series of specimens, which are quoted as "*F. flavipes* Szépligeti, var. an sp. nova", collected from the Bienkowice forest region in Poland. He gives no new name for these specimens and the descriptive notes are very inadequate. Until more information is available concerning this series, it is best only to mention it in passing.

This species may be distinguished from *F. laeviuscula* Szépl. by the roughly reticulated surface of the second abdominal tergite. In addition, the second abscissa of the cubitus is not present, whereas it is in *laeviuscula.*

Holotype, ♀.—Budapest, Hungary (no further data available) [Hungarian National Museum, Budapest].

***Foersteria laeviuscula* Szépligeti**

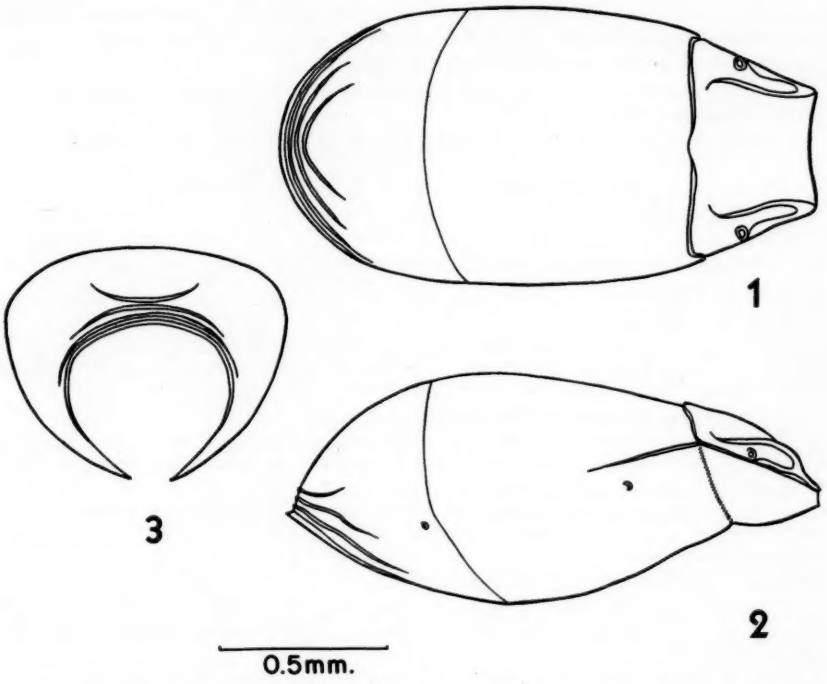
Szépligeti, 1896, Wien. Ent. Zeit. 15: 148 (♀; Monte-Maggiore Istria).—Szépligeti, 1896, Termes. Füzetek. 19: 301.—Dalla Torre, 1898, Catalogus Hymen. 4: 209.—Szépligeti, 1901, Potfuz. Termes. 33: 288 [in key to species].—Szépligeti, 1904, Math. Natur. Ber. Ungarn 19 (1901): 203.—Szépligeti, 1904, Genera Insect. Fasc. 22: 92 (Istria).—Fahringer, 1934, Opusc. Bracon. 3: 366 (bibliography).—Telenga, 1941, Faune de l'U.R.S.S. 5(3): 370, (♀).

This species was described from a single female specimen from Monte-Maggiore, Istria (southern Austria), by Szépligeti in 1896.

Homoeotype, ♀.—Length 3.5 mm., not including the ovipositor and its sheath, which is 2 mm. long. Black in colour except for the following: labrum yellowish; mandibles testaceous with dark-brown bases and apices; palpi yellowish; antennal scapes and pedicels with testaceous infusions on the ventral areas; legs testaceous except for the brownish infusions at the bases of the hind coxae and the apical parts of the hind tibiae and with the last tarsal segment of each leg brownish. Tegulae testaceous. Wings hyaline with the apical two-thirds of the costa and the stigma brown and the remaining veins paler.

Head, in general anterior outline, rather rectangular; nitidous and variously surfaced; vertex, temples, and genal regions smooth and shiny, the general surface with fine, sparse, setigerous punctures; frons more or less roughly and densely punctured, with the fronto-clypeal groove well impressed and with a fairly large, oval, anterior tentorial pit at each end. Clypeus transverse; dorsal part evenly punctured; the narrow ventral region smooth and shiny, with the labral margin straight and slightly reflexed. Labrum transverse. Palpi of moderate length. Antennal sockets well separated and with a suggestion of a broad tooth formed by a bend in the marginal carina on the dorso-lateral region of each socket; in the region behind the scapes, a short median row of shallow punctures. Ocelli large, circular, the ocellar triangle somewhat raised above the general surface of the vertex, with a slight depression in the central region. Antennae 28-segmented, all segments closely and evenly punctate and with rather dense, short pile; scapes short, the inner margins rather rounded; pedicels half as long as the scapes; first and second flagellar segments subequal, the remaining segments progressively shorter. Occipital carina complete and well developed throughout.

Thorax deep-set, and nitidous for the most part. Pronotum rather projected so as to form a blunt pedicel upon which the head rests; shiny, with a small apical, median depression and a few short, longitudinal carinae toward the base. Mesonotum shiny, its general surface sparsely covered with fine, setigerous punctures; notauli impressed and foveolate, particularly anteriorly, and almost straight as far as the area of convergence, which is a rather slightly depressed, triangular area; median and lateral lobes broadly rounded, the latter with their lateral ridges moderately developed. Scutellar groove wide, relatively deep, with only one strong central carina, and with the two lateral areas smooth and shiny. Scutellum trigonal in outline and rather flat and impunctate. Metanotum rather wide and roughly rugose. Propodeum rather finely punctate but strongly carinate; in profile slightly angled near the centre; central dorsal carina very short, dividing, the arms proceeding postero-laterally only to divide again with the outer branches proceeding toward the propodeal spiracles and the inner branches going toward the area of abdominal articulation, thereby delimiting a pentagonal region above the point of articulation; several shorter and weaker carinae proceeding laterally from these strong carinae, the areas confined by these carinae finely but irregularly punctate; the lower lateral regions smoother; propodeal spiracles circular, rather small, and slightly raised above the level of



Figs. 1-3. Abdomen of *Foersteria laeviuscula* Szépl. (all drawn to the same scale). 1, Dorsal view. 2, Lateral view. 3, End view.

the general surface. Mesopleura smooth and nitidous, with no indication of a central groove; lower anterior margin with a roughened groove and a marginal carina. The large lateral regions of the pronotum nitidous and finely but roughly and closely punctate for the most part, particularly in the upper and lower anterior regions. Tegulae rectangular with the outer margin somewhat rounded but impunctate and shiny. Wings hyaline, with the first abscissa of the radius equal to the second abscissa of the cubitus; submedian cell longer than the median cell, and with a suggestion of an anal cross-vein. Legs rather long, with all the femora relatively stout. Each tarsal claw with the basal part broad but with no definite basal tooth.

Abdomen (Figs. 1-3) elongate, about twice as long as broad, and with the general surface nitidous and sparsely covered with fine, setigerous punctures; first tergite finely punctured, wider at the apex than long, and with the centro-lateral carinae moderately developed, diverging but almost reaching the suture between the first and second tergites; laterally with a ridge extending from the point of articulation with the thorax caudad toward the first transverse suture; second and third tergites firmly coalesced, with the second transverse suture indicated by a slightly depressed, smooth line, and laterally with a sharp margin only at the immediate base of the second tergite, the rest of the tergites being smoothly rounded and continuous with the pleural region; general surface of the abdominal carapace smooth but with the apex of the third tergite with a few rounded, concentric ridges on its upper surface; pleural regions of the abdominal

segments very broad and in the dried specimen being described almost touching ventrally; ovipositor one and a half times as long as the abdominal carapace, slender, and with the sheath clothed with fine hairs.

Holotype, ♀.—Monte-Maggiore, Istria (no further data available) [Hungarian National Museum, Budapest].

Specimens Examined—1 ♀, Galgamacsa, Hungary 1926 (homoeotype).

Species Originally Placed in *Foersteria* Szépl.

NEOTROPICAL REGION

Triaspis ruficollis (Cameron) n. comb.

Triaspis ruficollis Cameron, 1904, Invert. Pacif., 1: 48 (San Marcos, Nicaragua).

ETHIOPIAN REGION

Triaspis apicalis (De Saeger) n. comb.

Foersteria apicalis De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 242 (Lac Grando, at the foot of the volcano Karisimbi, Ruanda, alt. 2400 metres, Belgian Congo; figs. 246, 266-271).

Triaspis apicalis semipolita (De Saeger) n. comb.

Foersteria apicalis semipolita De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 244 (Mont Sesero, near Bitashimwa, alt. 2000 metres, Belgian Congo).

Triaspis consobrina (De Saeger) n. comb.

Foersteria consobrina De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 250 (toward Rweru, Mikeno volcano, Bambous, alt. 2406 metres, Belgian Congo; figs. 283-286).

Triaspis crusta (De Saeger) n. comb.

Foersteria crusta De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 248 (Ruhengeri, sources Kirii, Ruanda, alt. 1800-1825 metres, Belgian Congo; figs, 248, 277-282).

Triaspis erythrocephala (De Saeger) n. comb.

Foersteria erythrocephala De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 257 (Rutshuru, riv. Musugereza, alt. 1100 metres, Belgian Congo; figs. 302-306).

Triaspis lissostriga (De Saeger) n. comb.

Foersteria lissostriga De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 234 (Rutshuru, riv. Kanzarue, alt. 1200 metres, Belgian Congo; figs. 250, 253-255).

Triaspis monticola (De Saeger) n. comb.

Foersteria monticola De Saeger, 1948, Explor. Parc Nat. Albert Miss. de Witte (1933-1935), fasc. 53: 246 (Kundhuru-ya-Tshuve, Turabagwe, Ruanda, alt. 2600 metres, Belgian Congo; figs. 249, 272-276).

Triaspis nana (De Saeger) n. comb.

Foersteria nana De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 240 (Rutshuru, riv. Musugereza, alt. 1100 metres, Belgian Congo; figs. 251, 263-265).

Triaspis nitida (Cameron) n. comb.

Foersteria nitida Cameron, 1911, Ann. Transvaal Mus., 2: 204 (Bronkhorstsptuit (Pretoria District) Transvaal).—Brues, 1926, Proc. Amer. Acad. Arts Science, 61: 396.—De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 234.

Triaspis remota (De Saeger) n. comb.

Foersteria remota De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 237 (Burambi, Muhavura volcano, Ruanda, alt. 2325 metres, Belgian Congo; figs. 247, 256-259).

Triaspis terebra (De Saeger) n. comb.

Foersteria terebra De Saeger, 1948, Explor. Parc Nat. Albert, Miss de Witte (1933-1935), fasc. 53: 239 (Kanyabayongo, Kabaska, alt. 1760 metres, Belgian Congo; figs. 252, 260-262).

Triaspis testudinata (De Saeger) n. comb.

Foersteria testudinata De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 254 (Gitebe, Nyamurigira volcano, alt. 2324 metres, Belgian Congo; figs. 244-245, 294-301).

Triaspis tridentata (De Saeger) n. comb.

Foersteria tridentata De Saeger, 1948, Explor. Parc Nat. Albert, Miss. de Witte (1933-1935), fasc. 53: 252 (May-ya-Moto, alt. 950 metres, Belgian Congo; figs. 243, 287-292).

Bibliography

Ashmead, W. H. 1900. Classification of the ichneumon flies, or the superfamily Ichneumonoidea. *Proc. U.S. Nat. Mus.* 23: 1206.

Brues, C. T. 1926. Studies on Ethiopian Braconidae, with a catalogue of the African species. *Proc. Amer. Acad. Arts Sci.* 61: 205-436.

Cameron, P. 1904. New Hymenoptera, mostly from Nicaragua, *Invert. Pacif.* 1: 46-69.

Cameron, P. 1911. On the parasitic Hymenoptera collected by Mr. A. J. T. Janse, Transvaal. *Ann. Transvaal Mus.* 2: 173-217.

Dalla Torre, C. G. de. 1898. Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus. 4: Braconidae.

De Saeger, H. 1948. Cardiochilinae et Sigalphinae (Hymenoptera Apocrita), Family Braconidae. *Explor. Parc Nat. Albert, Miss. de Witte* (1933-1935), Fasc. 53.

Fahringer, J. 1934. *Opuscula Braconologica.* Palaearktische Region. Band 3.

Niezabitowski, E. L. 1910. Materyały do fauny Brakonidow Polski, I. *Akademia Umiejetnosci w Krakowie Sprawozdanie Komisyi Fizyograficzne i ciagu roku 1909 oraz Materyały do fizyografii Krajowei* 44: 49-105.

Schmiedeknecht, O. 1930. Die Hymenopteren Nord- und Mitteleuropas. Fischer, Jena.

Szépligeti, G. 1896. Ueber Polydegmon Foerster und eine neue Gattung der Sigalphidae. *Wien. Ent. Zeit.* 15: 145-149.

Szépligeti, G. 1896. Adatok a Magyar fauna Braconidainak ismeretéhez. (Beitrage zur Kenntniss der Ungarischen Braconiden). *Természetrajzi Füzetek, Kiadja a Magyar nemzeti Museum* 19: 285-321.

Szépligeti, G. 1901. A palaearktibus Braconidak meghatarozo tablazatai. *Potfuzetek a Termeszettudomanyi Kozlonyhoz.* (*Beiblatter zu den naturwissenschaftlichen Mittheilungen*) 33: 261-288.

Szépligeti, G. 1904. Ubersicht der Gattung und Arten der palaarktischen Braconiden. *Mathematische und naturwissenschaftliche Berichte ans Ungarn mit Unterstutzung der Ungarischen Akademie der Wissenschaften und der Koniglich Ungarischen Naturwissenschaftlichen Gesellschaft* (1901) 19: 145-203.

Szépligeti, G. 1904. Hymenoptera. Fam. Braconidae. *In* Genera Insectorum, by P. Wytsman, Fasc. 21.

Telenga, N. A. 1941. Fam. Braconidae: sous-fam. Braconinae (cont.) et Sigalphinae. *Faune de l'U.R.S.S. Insectes Hyménoptères* 5(3).

Viereck, H. L. 1914. Type species of the genera of ichneumon flies. *U.S. Nat. Mus. Bull.* 83.

(Received September 25, 1953)

A Simplification of Hubbell's Method for Trapping and Preserving Specimens of *Ceuthophilus*[1] (Orthoptera, Gryllacrididae)

By J. R. Beaudry[2]

Insects of the genus *Ceuthophilus* although widely distributed in North America are seldom encountered by the collector unless attracted and captured by means of Hubbell's molasses traps[3,4]. These traps, which consist of glass jars (Hubbell recommends pint-size Mason jars) containing half an inch to an inch of molasses diluted one-half with water, are buried to the brim in the ground or heaped around with stones, leaves, etc., to give access to the edge of the jar. Hubbell[4] recommends placing them ". . . at least ten feet apart, and where ground-cover is scanty . . . , near such as does occur" in habitats or situations which are expected to yield specimens of *Ceuthophilus*: almost any type of forest, rock piles, stone fences, vicinity of the openings of mammal burrows, caves, certain grasslands, etc. . . . The traps are visited after they have been in

[1]Work done under a project supported by the National Research Council of Canada for the study of the cytogenetics of Orthoptera.

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position for one or more nights. The specimens which they may contain are of course dead, having drowned in the liquid by which they were attracted; they are placed on a square of cheese-cloth, which is tied into a packet and labeled. After thorough washing in water the packet is dropped into 80% alcohol, in which the specimens can be kept until needed.

Hubbell's method is satisfactory if the insects are to be kept in alcohol, before and after study. But it involves considerable and tedious subsequent work if they are to be dried and pinned, since the molasses swallowed by the insect must be eliminated to assure conservation. This requires evisceration or can be accomplished through diffusion (after slitting the pleurites of one side) in many changes of 40 to 50% alcohol, followed by two changes of 95% alcohol, two changes of absolute alcohol (or water-free acetone or synthetic methyl alcohol), and finally xylene. Moreover, this method is useless to those who, like the cytologist, need living specimens for the preparation of their materials.

An attempt was made last summer to modify Hubbell's molasses traps for the purpose of catching living specimens which could be used for cytological purposes, or subsequently killed and pinned without being submitted to the elaborate preparation described above. A number of devices—disks of copper wire set immediately above the molasses solution to avoid contact of the specimens with it; cones of copper wire bearing an opening at the summit of the cone and inverted into the jar and fastened to the brim to prevent escape, etc. . . .,—were added to Hubbell's traps. But it was found out that all these could be dispensed with and that the best results were obtained with an utterly simple trap. It consists of a wide-mouth glass jar (3-5″ in diameter, and 5-6″ in height), the inner bottom and wall of which have been coated with the diluted molasses, and containing enough dead leaves to cover its bottom loosely. The coating of the traps is effected by pouring a small quantity of molasses solution into the jar, which is then inclined and rolled until its inner wall has been coated to the brim. The solution is then poured out and can be used on subsequent days (until too dirty) if kept in a refrigerator.

When a number of these traps are set as described above, it is found that they yield at least as many specimens of *Ceuthophilus* as Hubbell's traps. In a comparative test involving only two Hubbell's traps and two modified traps set in a deciduous wood of the region of Montreal, Que., during 8 nights in late June and early July of 1953, the two Hubbell traps yielded 22 specimens of *Ceuthophilus* and the two modified traps, 39. The modified traps were subsequently set at three other localities, always with good results. At one of these localities (Ste-Geneviève-de-Pierrefonds, Jacques-Cartier Co., Que.) 12 specimens of the seldom encountered *Parcoblatta pennsylvanica* (De Geer) were also captured.

The specimens of *Ceuthophilus* caught with these modified traps are found hidden under the leaves, and are of course very clean. They can be kept alive until needed, or killed and pinned immediately.

Thanks are extended to Miss Colette Girard who helped us to devise this method.

References

(3) Hubbell, T. H. *in* Hebard, M. The Orthoptera of Minnesota. (*Univ. Minn. Agr. Exp. Sta. Techn. Bull.* 85: p. 47. 1932).

(4) Hubbell, T. H. A Monographic Revision of the Genus *Ceuthophilus* (Orthoptera, Gryllacrididae, Rhaphidophorinae). *Univ. Florida Publ., Biol. Sci. Ser. II*, No. 1, pp. 12-14. 1936).

(Received October 28, 1953)

Canadian Species of *Latalus* (Homoptera: Cicadellidae)[1]

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Three North American species of *Latalus* and four of *Quontus* were listed by Oman (1949). Two of these are conspecific with a third and three new species are described below. Two of the previously described species have not been found in Canada and are not discussed here. They are *Deltocephalus latidens* Sanders and DeLong (1919, p. 234) and *Latalus uncinatus* Beamer and Tuthill (1934, p. 6). They are distinguished by genitalic characters described in the original descriptions. *Quontus* Oman (1949) is treated here as a synonym of *Latalus* DeLong and Sleesman (1929), as the distinctions given by Oman (1949) intergrade and do not always hold good. Canadian species of *Latalus* apparently inhabit grasslands. The best specific characters are in the internal male genitalia, though the female seventh sternite shows valid characters in some species.

Key to Males

1. Aedoeagus with one or more pairs of spine-like processes at or near apex 2
   Aedoeagus without processes. Western ..... *missellus* (Ball)
2. Aedoeagus slender or stout, strongly curved upward in lateral views 3
   Aedoeagus stout, curved downward in lateral view. Eastern ..... *sayi* (Fitch)
3. Aedoeagus with a single pair of processes 4
   Aedoeagus with two or three pairs of processes 5
4. Aedoeagus flattened, with shaft broad in ventral view, slender in lateral view. Manitoba ..... *hultus* n. sp.
   Aedoeagus not flattened, with shaft no broader in ventral than in lateral view. British Columbia ..... *curtus* B. & T.
5. Aedoeagus with three pairs of processes. East of Rockies ..... *personatus* n. sp.
   Aedoeagus with two pairs of processes. British Columbia ..... *bistrionicus* n. sp.

Latalus missellus (Ball)

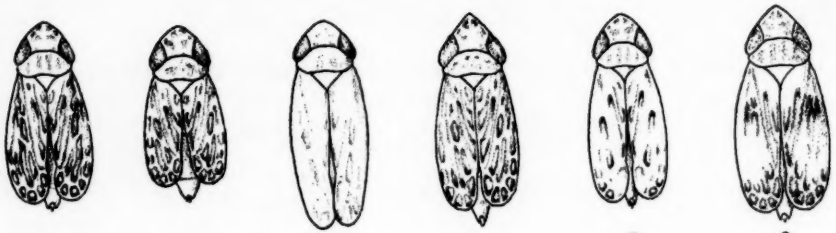
Figs. 1, 7, 13

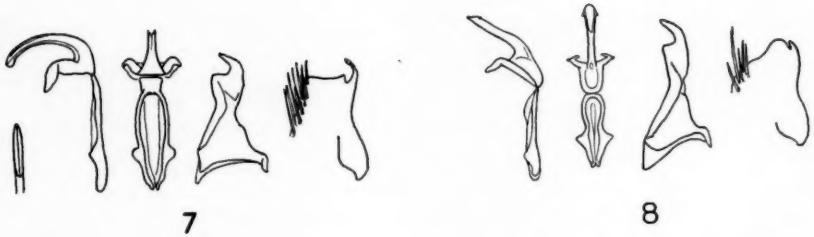
Deltocephalus missellus Ball, 1899: 191.
Deltocephalus missellus var. *occidentalis* Delong, 1926: 41.
Latalus mundus Beamer and Tuthill, 1934: 6. New synonymy.

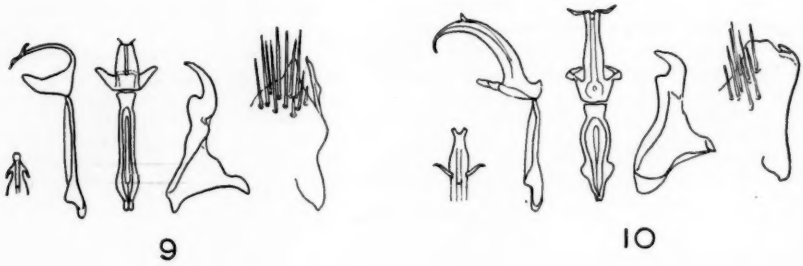
This species has been confused with *personatus*, of which the male genitalia were figured by DeLong and Sleesman (1929) and DeLong (1948) as of *missellus*. The variety *occidentalis* was listed as a valid species by DeLong and Knull (1945) and Oman (1949). According to the original description, it differs from *missellus* (or *personatus*?) in characters of the female seventh sternite. These differences are covered by individual variation, and the male genitalia of specimens identified as of *occidentalis* from associated females are identical with those of *missellus*. *L. mundus* is identical with *missellus* in characters of the male genitalia. The aedoeagus of *missellus* is distinctive. The female seventh sternite resembles in shape those of *personatus* and *histrionicus*, but tends to be more strongly produced in the middle of the posterior margin and the central region lacks the pair of black spots that are usually present in those species.

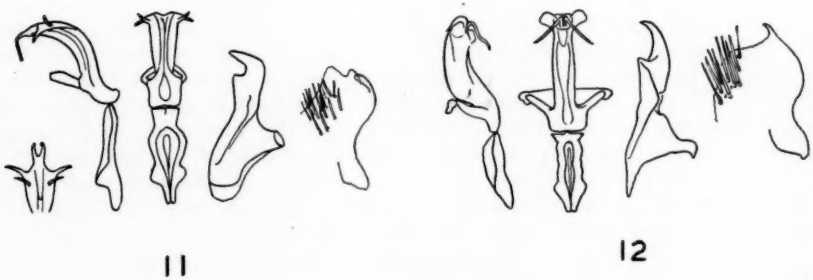
Though DeLong (1926, 1948), DeLong and Knull (1945), and Oman (1949) indicate that this species has a transcontinental distribution, it is probable that records from eastern North America refer to *personatus*. *L. missellus* is known to occur in British Columbia, Saskatchewan, Colorado, Wyoming, Oregon, and Montana.

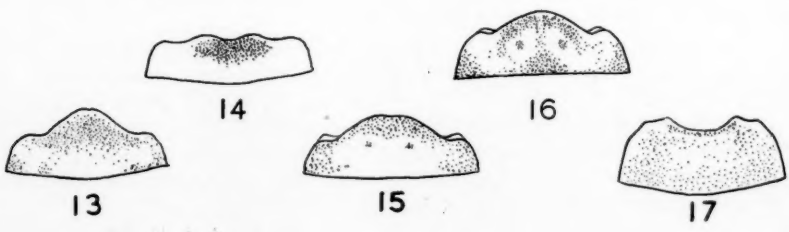
[1]Contribution No. 3123, Entomology Division, Science Service, Department of Agriculture, Ottawa, Canada.
[2]Agricultural Research Officer.


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Latalus curtus B. & T.

Figs. 2, 8, 14

Latalus curtus Beamer and Tuthill, 1934: 5.

The form of the aedoeagus is distinctive. The female seventh sternite is relatively short, and, unlike those of related species, has the posterior margin weakly emarginate rather than medially produced.

The species was described from specimens collected in British Columbia. Specimens from that province were examined.

Latalus hultus n. sp.

Figs. 3, 9

Length 3.2 mm. General colour stramineous. Vertex with indications of darker areas on disc. Fore wing yellowish hyaline, with the veins broadly yellow and the cells weakly margined brownish interiorly.

Aedoeagus with shaft recurved, flattened, broad in ventral view, slender in lateral view, with gonopore on ventral (posterior) surface toward apex and shaft grooved beyond opening, with a pair of downward-directed, pointed, lateral processes beyond gonopore, and with the apex rounded. Apical arm of style relatively long, curved. Pygofer produced to a blunt point at apex and with a long, irregular spine from the posterolateral corner.

The genitalic characters are distinctive. Though this species has relatively long fore wings as compared with other species of *Latalus*, it evidently belongs to this genus.

Holotype, ♂:—Same data as holotype.

Latalus histrionicus n. sp.

Figs. 4, 10, 15

Length 3.0—3.5 mm. General colour stramineous, with ochreous or brownish markings. Vertex with two pairs of dark lines near anterior margin, each forming the anterior margin of an ochreous or brownish spot. Face with numerous dark-brown areas, confluent medially. Pronotum with brownish or ochreous spots near anterior margin and on disc, and sometimes with indications of ochreous or brownish longitudinal bands. Fore wing with cross-veins marked whitish, and with most or all of the cells margined brown internally.

Vertex distinctly pointed, aedoeagus curved upward, with apex reflexed; gonopore on ventral (posterior) surface of shaft beyond middle, and shaft grooved beyond the opening; apical region with two pairs of processes: a short, blunt pair formed of the bifurcate apex and a longer pair arising from the ventral (posterior) surface just beyond the gonopore. Style and pygofer and female seventh sternite as in *personatus*.

This species resembles *missellus* and *personatus* in external characters but the vertex is more distinctly pointed. The male genitalia are distinctive. The species shows close relationship to *personatus* on genitalic characters but the aedoeagus is more slender and has only two pairs of processes.

Captions for Figures

Figs. 1-17.—*Latalus* spp.

Figs. 1, 2, and 4-6, females, 3, male, of: 1, *L. missellus* (Ball); 2, *L. curtus* B. & T.; 3, *L. hultus* n. sp.; 4, *L. histrionicus* n. sp.; 5, *L. personatus* n. sp.; 6, *L. sayi* (Fitch).

Figs. 7-12. Male genitalia. Posterodorsal view of apical region of aedoeagus (Figs. 7, 9-11), lateral view of aedoeagus, and connective, style, and pygofer of: 7, *L. missellus;* 8, *L. curtus;* L. *hultus;* 10, *L. histrionicus;* 11, *L. personatus;* 12, *L. sayi.*

Figs. 13-17. Female seventh sternite of: 13, *L. missellus;* 14, *L. curtus;* 15, *L. histrionicus;* 16, *L. personatus;* 17, *L. sayi.*

B & C Library

Described from ten specimens collected in British Columbia. It seems probable that some records for *missellus* from western North America may refer to this species.

Holotype, ♂:—Victoria, British Columbia, August 30, 1920 (W. Downes). No. 6102 in the Canadian National Collection.

Allotype, ♀:—Victoria, British Columbia, August 8, 1923 (K. F. Auden).

Paratypes:—2 ♂, 2 ♀, same data as allotype; 1 ♂, Victoria, August 28, 1923 (K. F. Auden); 1 ♂, Soda Creek, July 8, 1949 (G. J. Spencer); 1 ♂, Soda Creek, July 8, 1949 (R. Stace-Smith); 1 ♂, Quesnel, July 3, 1949 (R. Stace-Smith).

***Latalus personatus* n. sp.**

Figs. 5, 11, 16

Deltocephalus missellus DeLong, 1926: 40. *Nec* Ball.
Deltocephalus missellus DeLong and Sleesman, 1929: 107. *Nec* Ball.
Latulus missellus DeLong, 1948: 237. *Nec* Ball.

Length 2.8—3.2 mm. General colour greyish-stramineous, with ochreous or brownish markings. There is variation in the intensity and degree of development of the dark markings. Vertex with two pairs of dark lines near anterior margin, each forming the anterior margin of a larger, ochreous or brownish spot. Face with numerous dark areas that are more or less confluent medially. Pronotum with variable dark spots near anterior margin and on disc, forming indefinite longitudinal bands in well-marked specimens. Fore wing with veins broadly yellow, those bordering the anteapical and fourth apical cells often white; the apical, anteapical, and inner discal cells broadly margined brown internally, and sometimes all cells of fore wing dark-margined internally.

Aedoeagus broad in lateral and ventral views, flattened dorsoventrally with a median, dorsal, longitudinal ridge; shaft curved upward and apex reflexed; gonopore on ventral (posterior) surface of shaft, which is grooved beyond the opening; apical third of shaft wth three pairs of processes: an anteriorly directed pair formed of the bifurcate apical region, a lateral pair that are expansions of the flattened ventral apical region, and a pair arising from the ventral (posterior) surface below these. Pygofer with a broad tooth at posteroventral corner, which is directed inward to meet the tooth of the opposite side in the mid-line. Posterior margin of female seventh sternite with lateral corners slightly produced and median region roundedly expanded; the sternite usually with two dark spots on disc and usually variably marked brown or blackish.

This species resembles *missellus* and *histrionicus* on external characters but can be readily recognized by the aedoeagus. The vertex tends to be more distinctly pointed than in *histrionicus*, but otherwise no reliable characters to separate females of the two species could be found. The sternite of *missellus* differs from those of *personatus* and *histrionicus* in that the posterior margin is more distinctly produced medially and the pair of dark spots, which usually are present on the disc in those species, is absent.

Because this species has been confused with *missellus* it is probable that records for *missellus* from eastern North America should refer to *personatus*. The species appears to have a wide distribution in North America east of the Rockies. Described from 35 males and 35 females collected in Quebec, Ontario, Manitoba, and Saskatchewan.

Holotype, ♂:—Saskatoon, Saskatchewan, July 12, 1949 (A. R. Brooks). No. 6101 in the Canadian National Collection.

Allotype, ♀:—Saskatoon, Saskatchewan, July 28, 1950 (A. R. Brooks).

Paratypes:—2 ♂, 4 ♀, same data as holotype; 2 ♂, 3 ♀, same data as allotype; 1 ♂, Saskatoon, Saskatchewan, July 5, 1949 (A. R. Brooks); 1 ♂, Saskatoon,

Saskatchewan, August 16, 1949 (A. R. Brooks); 10 ♂, Saskatoon, Saskatchewan, July 7, 10, and August 3, 1926, July 9, 10, 24 (two specimens), and September 12, 1928, and July 22 and August 17, 1929 (K. M. King); 3 ♂, 2 ♀, Rosetown, Saskatchewan, July 27, 1925 (N. J. Atkinson); 1 ♂, Duck Lake, Saskatchewan, July 15, 1925 (K. M. King); 1 ♂, Melfort, Saskatchewan, July 16, 1925 (K. M. King); 1 ♂, 2 ♀, Torch River, Saskatchewan, August 14, 1950 (L. A. Konotopetz) [L. A. Kelton]; 1 ♂, Aweme, Manitoba, July 17, 1930 (R. M. White); 1 ♂, Natashquan, Quebec, August 1, 1929 (W. J. Brown); 14 ♀, do., August 5, 1929 (five), August 7, 1929 (six), July 25, 1930, and August 1, 1930 (two), (W. J. Brown); 1 ♂, 6 ♀, Kazubazua, Quebec, July 20, 1927 (W. J. Brown); 2 ♂, 1 ♀, do., July 16, 1927 (G. S. Walley); 1 ♂, do., July 18, 1931 (G. S. Walley); 1 ♂, Schwartz, Quebec, August 6, 1931 (G. S. Walley); 1 ♂, 1 ♀, Aylmer, Quebec, July 28, 1931 (G. S. Walley); 1 ♂, Normandale, Ontario, June 5, 1931 (G. S. Walley); 1 ♂, 1 ♀, Fisher Glen, Ontario, June 12, 1931 (G. S. Walley); 1 ♂, do., June 15, 1931 (G. S. Walley); 1 ♂, do., June 16, 1931 (G. S. Walley).

Latalus sayi (Fitch)

Figs. 6, 12, 17

Amplicephalus sayi Fitch, 1851: 61.

This species tends to be more strongly marked than the others under discussion. It has a distinctly banded appearance, caused by the heavy brown internal margins of the cells of the apical and median areas of the forewing. The aedoeagus, style, and female seventh sternite are distinctive.

This appears to be a common species in eastern North America. Specimens from localities in New Brunswick, Quebec, and Ontario were examined.

Acknowledgments

The author wishes to express his thanks to Professor R. H. Beamer, University of Kansas, for a paratype of *Latalus mundus*, and to Dr. David A. Young, Jr., Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, for facilitating study of material in the collections of the United States National Museum, Washington, D.C.

References

Ball, E. D. 1899. Some new species of *Deltocephalus*. *Canadian Ent.* 31: 188-192.

Beamer, R. H., and L. D. Tuthill. 1934. Some new species and a new genus of deltocephaloid leafhoppers (Homoptera, Cicadellidae). *J. Kansas Ent. Soc.* 7: 1-24.

DeLong, D. M. 1926. A monographic study of the North American species of the genus *Deltocephalus*. *Univ. Stud. Ohio Sta. Univ.* 2: 1-129.

DeLong, D. M. 1948. The leafhoppers, or Cicadellidae, of Illinois. *Bull. Illinois Nat. Hist. Surv.* 24: 97-276.

DeLong, D. M., and D. J. Knull. 1945. Check list of the Cicadellidae (Homoptera) of America, north of Mexico. *Ohio Sta. Univ. Grad. Sch. Stud. Biol. Sci. Ser.* 1.

DeLong, D. M., and J. P. Sleesman. 1929. New genera and subgenera from the genus *Deltocephalus*. *Ann. Ent. Soc. America* 22: 81-114.

Fitch, A. 1851. Catalogue with references and descriptions of the insects collected and arranged for the State Cabinet of Natural History. *Ann. Rept. (New York) Sta. Cab. Nat. Hist.* 4: 43-69.

Oman, P. W. 1949. The Nearctic leafhoppers. *Mem. Ent. Soc. Washington* 3.

Sanders, J. G., and D. M. DeLong. 1919. Eight new "jassids" from the eastern United States. Family Cicadellidae (Hemiptera—Homoptera). *Ann. Ent. Soc. America* 2: 231-238.

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The Influence of Spray Programs on the Fauna of Apple Orchards in Nova Scotia. VII. Effects on Some Beneficial Arthropods[1]

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The toxicities of a large number of spray chemicals to arthropod pests are well known. In most instances, observations on the effects of such materials on natural enemies have beeen incidental to other studies, and little has been published on experiments designed to determine the direct toxicities of the chemicals to beneficial species. The effects of spray chemicals on the predators and parasites of the major pests of apple trees in Nova Scotia have been investigated as part of a broader project on the factors that influence population densities of orchard arthropods, as outlined by Pickett *et al.* (31).

These studies have shown that the use of spray chemicals may have other and more important consequences than their toxic effects on the pests, one of the most harmful being the killing of biotic control agents. This harmful effect is usually apparent only after a considerable period and then only when the beneficial species is an important factor in the control of some pest.

Information on the value of natural enemies in the control of many apple pests in Nova Scotia has brought about changes in the spray program. These changes have been made to avoid the use of materials that destroy the beneficial species. The data reported here (Table II) have contributed information basic to such changes.

The results of these studies are of limited value because, first, not all chemicals have been tested against all beneficial species; and, second, more applications, certain combinations of chemicals, or different conditions during application may change the end results. With due allowance for these limitations, the type of data gathered in the studies is fundamental to the planning of protection programs that will utilize natural control factors to optimum advantage.

The chemical method of controlling pests in orchards has become increasingly complex. There is already concrete evidence that, in many instances, this is due to the destruction of natural enemies. The authors are of the opinion that measures to protect the beneficial species will become a major consideration in pest control. These data, although not complete, are presented at this time so that they may be appraised by workers elsewhere. It is only through the accumulation of data on the adverse, as well as the beneficial, effects of spray chemicals that a satisfactory appraisal of such materials can be made.

Methods

The greater part of the information reported here was obtained from plots of three or four trees each. The tests were conducted where a high or a moderate population of a beneficial species was present. Plot replicates were used where possible, or the individual plots were divided into two or more sampling units. Population counts were made before and at intervals after the chemicals were applied. The concentrations used were those recommended in official spray calendars or, with new materials, in the manufacturers' directions. As a rule, the plots were treated only once. The plot and orchard populations were sampled by the following methods as described by the senior author (28): dusting, jarring, and visual counts. The last method involved counts of speci-

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TABLE I

Some biotic control agents in apple orchards in Nova Scotia, hosts, and active periods

Predator(s) and Parasite(s)	Host(s)							Active period
	Phytophagous mites	Codling moth		Eye-spotted bud moth		Aphids	Oyster-shell scale	
		eggs	larvae	eggs	larvae			
Thysanoptera								
Haplothrips faurei Hood	++*	++		++	+			May—October
Leptothrips mali (Fitch)	++	++		++				June—October
Miridae								
Hyaliodes harti Knight	++	++	++	++	+			July—mid August
Diaphnidia pellucida Uhl.	++					+		June—July
Deraeocoris fasciolus Knight	++	+	++	+	+	++		June—July
Plagiognathus obscurus Uhl.	++	+	++			++		Mid June—July
Criocoris saliens (Reuter)	++							June—July
Pilophorus perplexus D. & S.	++		+					July—August
Campylomma verbasci (Meyer)	++					++		Mid June—mid July
Anthocoridae								
Anthocoris musculus (Say)	++			++	++			May—October
Coccinellidae								
Stethorus punctum (Lec.)	++							July—August
Other coccinellids	++	+	+	+	++	++		June—October
Acarina								
Anystis agilis Banks	++				++	++		June—September
Typhlodromus spp.	++							May—October
Mediolata novae-scotiae Nes.	++							May—October
Hemisarcoptes malus (Shimer)							++	May—October
Parasitic Hymenoptera								
Aphytis mytilaspidis (LeB.)							++	May—October
Ascogaster quadridentata Wesm.			++		++			July
Euderus spp.					++			July—September
Scambus spp.					++			June—mid July
Agathis laticinctus (Cress.)					++			Mid July—mid August
Trichogramma minutum Riley		++		++				July—mid August

* Known to attack, ++; suspected to prey, circumstantial evidence, +.

TABLE II

Effects of spray chemicals on predator and parasite populations in Nova Scotia orchards

Predator(s) and Parasite(s)	Spray chemical	DDT	Parathion	Lead arsenate	Arsenate of lime	Cryolite	Nicotine sulphate	Fixed nicotine	Summer oil	Ovotran[1]	Copper (bordeaux)	Copper (fixed)	Sulphur	Lime-sulphur	Phygon[2]	Ferbam	Tag 331[3]	Crag Fruit Fungicide[4]
H. faurei		++	++++	o	|	|	o	o	++	o	|	o	|	+	o	|	o
L. mali		++++++++++	++++++	o++	|	|	++	|	o	|	o	|	o	|	o	o	o
H. harti				o	|	o	o	|	|	o	|	o	|	o	|	o	|
D. pellucida		++++++	++++++	o	|	|	o	|	o	|	o	|	o	|	o	|	o
D. fasciolus				o	|	|	+	o	|	|	o	|	o	|	o	|	o
P. obscurus		++++++	+	o	|	|	++	|	|	|	o	|	o	|	o	|	o
C. saliens		o	++++++	o	|	|	o	|	o	|	o	|	o	|	o	|	o
P. perplexus		+	|	o	|	o	|	+	o	|	o	|	o	|	o	|	o
C. verbasci		|	|	+	|	o	o	+++	o	|	o	|	o	|	o	|	o
A. musculus		|	|	o	|	o	o	|	|	|	o	|	o	|	o	|	o
S. punctum		|	|	o	|	o	o	o	o	|	o	|	o	|	o	|	o
A. agilis		++	++	+	|	|	o	+	|	|	o	|	o	|	o	|	o
Typhlodromus spp.		+++	++++++	o	|	o	+	o	|	|	o	|	o	|	o	|	o
M. novae-scotiae		o	+	o	|	o	o	o	|	|	o	|	o	|	o	|	o
H. malus		++	+	o	|	o	+	o	|	|	o	|	o	|	o	|	o
A. mytilaspidis		+	|	o	|	o	+	o	|	|	o	|	o	|	o	|	o
A. quadridentata		|	|	++	|	|	|	|	|	|	|	|	|	|	|	|	|
Euderus spp.		|	|	++	|	|	|	|	|	|	|	|	|	|	|	|	|
Scambus spp.		|	|	++	|	|	|	|	|	|	|	|	|	|	|	|	|
A. laticinctus		|	|	+	|	|	|	|	|	|	|	|	|	|	|	|	|
T. minutum		+	|	o	|	|	|	|	|	|	o	|	o	|	o	|	o	|

* No information, –; no effect, o; partial reduction of numbers, +; practical elimination, ++; possible reduction, evidence inconclusive, +o.

1 p-chlorophenyl–p-chlorobenzene sulphonate (Dow Chemical Co.).
2 Dichloro naphthoquinone (Naugatuck Chemicals).
3 Organic mercury (California Spray-Chemical Corporation).
4 Heptadecyl glyoxalidine acetate (Carbide & Carbon Chemicals Co.).

TABLE III

TABLE III

Effects of spray chemicals on predator and parasite populations (Literature review)

Predator(s) and Parasite(s) / Spray chemical	DDT	Parathion	Lead arsenate	Cryolite	Nicotine sulphate	Fixed nicotine	Summer oil	Pyrethrum	Chlordane	Sulphur	Ferbam	Reference(s)
Thysanoptera												
Leptothrips mali (Fitch)	++*											7
Scolothrips sexmaculatus (Perg.)	++											7
Miridae												
Diaphnidia pellucida Uhl.					o			o				39
Anthocoridae												
Orius spp.	++								+			22(p.12),30
Nabidae												
Nabis spp.	++											22(p.12)
Lygaeidae												
Geocoris punctipes (Say)	+o								++			38,30
Coleoptera												
Carabids	++											37
Coccinellidae												
Stethorus punctum (Lec.)	++	+	o	+o	o		+		+	o		13,40,7,34,21
Scymnus binaevatus Muls.	++											24
Rodolia cardinalis (Muls.)	++											12,13
Cryptolaemus montrouzieri Muls.				++						++		1 (p.51)
Other coccinellids	++	++	+		+		o					1,20,29,38,45
Neuroptera												
Chrysopa spp.	+			+	o		o		o			13,14,42,46
Conwentzia spp.	++			++					++			13

TABLE III

Effects of spray chemicals on predator and parasite populaion (Literature review)—*continued*

Predator(s) and Parasite(s) / Spray chemical	DDT	Parathion	Lead arsenate	Cryolite	Nicotine sulphate	Fixed nicotine	Summer oil	Pyrethrum	Chlordane	Sulphur	Ferbam	Reference(s)
Diptera												
Syrphid larvae	+				+o							32,44,47,42,33
Acarina												
Typhlodromids	++	++			o		o			++	++	7,25,18(p.23),10
Parasitic Hymenoptera												
Allotropa spp.	++											11,23
Anagrus spp.	o									+		27,1(p.51)
Anarhopus sydneyensis (Timb.)	o											13
Aphelinus mali (Hald.)	++											43
Aphelopus typhlocybae (Mues.)			o				+			o		39
Aphycus helvolus Comp.							o			++		2(p.25),46,16,17
Aphycus lounsburyi How.		++										46
Aphycus luteolus Timb.			+	+		o	o			+		4
Ascogaster quadridentata Wesm.	++											15,5,8,9
Clausenia purpurea Ishii	++											11,23
Dacnusa gracilis (Nees)	++											47
Encarsia formosa Gah.	++											45
Macrocentrus ancylivorus Roh.	++											36
Prospaltella aurantii How.	++						+o					19
Pseudhomalopoda prima Gir.	++						++					19
Pseudaphycus sp.	++											11,23
Tetracnemus pretiosus Timb.	++											13
Trichogramma minutum Riley		+	+o			+o	+	++		++		26,8,41,6(p.427), 35(p.748),3

* Practical elimination, ++; partial reduction of numbers, +; no effect, o; possible reduction, evidence inconclusive, +o; no information.

mens on a unit number of leaves with dissecting microscopes, or visual examinations of foliage for given units of time.

Results were evaluated also by comparing the subsequent changes in host populations of treated plots with those of check plots. Additional information was obtained from sampling commercial and other experimental orchards.

Consideration was given to the biologies of the insects in order to distinguish between population changes due to natural phenomena and those caused by chemical treatments.

Results and Discussion

A list of the natural enemies on which some work has been done is given in Table I, along with their hosts and their periods of activity. The results of toxicity tests carried out on each beneficial species are given in Table II.

The experimental data summarized in Table II show that DDT, parathion, and sulphur have drastic effects on natural enemies. Nicotine, lead arsenate, summer oil, Ovotran, Phygon, and ferbam are harmful to some species and innocuous to others. Crag Fruit Fungicide, Tag 331, copper fungicides, and cryolite are relatively harmless to parasites and predators under conditions encountered in Nova Scotia orchards.

A review of pertinent literature (Table III) shows the effects that certain chemicals have on beneficial species in areas outside Nova Scotia. The results obtained by various workers show considerable variation, due presumably to different experimental conditions. The evaluations in Table III are deduced from results given in the publications and are in some cases a compromise of the findings of two or more authors where they differ.

The insecticides behave as might be expected: certain species are susceptible but others are relatively resistant to them. Fungicides have more effect on parasites and predators than might be expected. Sulphur sprays are known to have insecticidal action on some pests but most other fungicides have been considered harmless to insects. However, these studies have shown that not only sulphur but also other fungicides heretofore considered innocuous are very injurious to certain beneficial species and have interfered with the natural control of some important pest species. Therefore, it is considered necessary to determine the effects of a chemical on each pest and on beneficial species before it is safe to conclude that in a spray schedule its useful effects sufficiently offset its harmful ones.

Acknowledgments

The authors are indebted to the other staff members of the Kentville laboratory for their assistance and criticism. Special thanks are due Mr. H. T. Stultz, who contributed the data on the parasites of the eye-spotted bud moth.

References

1. Annand, P. N. 1942. Report of the Chief of the Bureau of Entomology and Plant Quarantine, 1942. U.S. Dept. Agr.
2. Annand, P. N. 1944. Report of the Chief of the Bureau of Entomology and Plant Quarantine, 1943 U.S. Dept. Agr.
3. Bare, C. O. 1935. Some remarks concerning the egg parasite *Trichogramma minutum* Riley, in Florida. *J. Econ. Ent.* 28: 803-815.
4. Bartlett, B., and W. H. Ewart 1951. Effect of parathion on parasites of *Coccus hesperidum*. *J. Econ. Ent.* 44: 344-347.
5. Boyce, H. R. 1943. The relation of some apple sprays to codling moth parasitism by *Ascogaster quadridentatus* Wesm. *73rd Ann. Rept. Ent. Soc.* Ontario, 1942, pp. 58-61.
6. Britton, W. E. 1933. Connecticut State Entomologist thirty-second report, 1932. *Connecticut Agr. Expt. Sta. Bull.* (New Haven) 349: 365-460.
7. Clancy, D. W., and H. N. Pollard. 1952. The effect of DDT on mite and predator populations in apple orchards. *J. Econ. Ent.* 45: 108-114.

* Practical elimination, ++; partial reduction of numbers, +; no effect, o; possible reduction, evidence inconclusive, ±; no information.

8. Clausen, C. P. 1936. Insect parasitism and biological control. *Ann. Ent. Soc. America* 29: 201-223.
9. Collins, D. L. 1934. The occurrence of *Ascogaster carpocapsae* in illuminated and sprayed areas of an apple orchard. *J. Econ. Ent.* 27: 379-382.
10. Cutright, C. R. 1944. Populations of the European red mite as affected by spray schedules. *J. Econ. Ent.* 37: 499-502.
11. Cutright, C. R. 1951. Comstock mealy bug in Ohio. *J. Econ. Ent.* 44: 123-124.
12. DeBach, P. 1947. Cottony cushion scale, Vedalia and DDT in central California. *California Citrograph* 32: 406-407.
13. DeBach, P., and B. Bartlett. 1951. Effects of insecticides on biological control of insect pests of citrus. *J. Econ. Ent.* 44: 372-383.
14. Doutt, R. L., and K. S. Hagen. 1949. Periodic colonization of *Chrysopa californica* as a possible control of mealy bugs. *J. Econ. Ent.* 42: 560-561.
15. Driggers, B. F., and W. J. O'Neill. 1938. Codling moth parasitism under different spray treatments. *J. Econ. Ent.* 31: 221-223.
16. Flanders, S. E. 1942. *Metaphycus helvolus*, an encyrtid parasite of the black scale. *J. Econ. Ent.* 35: 690-698.
17. Flanders, S. E. 1943. The susceptibility of parasitic Hymenoptera to sulphur. *J. Econ. Ent.* 36: 469.
18. Garman, P., and J. F. Townsend. 1938. The European red mite and its control. *Connecticut Agr. Expt. Sta. Bull.* (New Haven) 418.
19. Griffiths, Jr., J. T., and C. R. Stearns. 1947. A further account of the effects of DDT when used on citrus trees in Florida. *Florida Ent.* 30: 1-8. Cited in *Rev. Appl. Ent.*, A, 38: 219-220. 1950.
20. Haug, G. W., and A. Peterson. 1938. The effect of insecticides on a beneficial coccinellid, *Hippodamia convergens* Guer. *J. Econ. Ent.* 31: 87-92.
21. Houser, J. S., and C. R. Cutright. 1941. The European red mite. *Proc. Ohio Hort. Soc.* 74: 26-34. Cited in *Rev. Appl. Ent.*, A, 30: 536. 1942.
22. Hill, R. E. 1945. Effects of DDT on other insecticides on several species of potato insects. *Nebraska Agr. Expt. Sta. Res. Bull.* (Lincoln) 138.
23. Hough, W, S., D. W. Clancy. and H. N. Pollard. 1945. DDT and its effect on the comstock mealybug and its parasites. *J. Econ. Ent.* 38: 422-425.
24. Huffaker, C. B. 1948. A technique for translocation of DDT in plants. *J. Econ. Ent.* 41: 650-651.
25. Huffaker, C. B., and C. H. Spitzer, Jr. 1951. Data on the natural control of the cyclamen mite on strawberries. *J. Econ. Ent.* 44: 519-522.
26. Ingram, J. W., E. K. Bynum, and L. J. Charpentier. 1948. Experiments with insecticides against the sugarcane borer in 1947. *J. Econ. Ent.* 41: 914-918.
27. Jones, P. R., L. C. Glover, and R. Hansberry. 1946. An oil-DDT vapor spray to control grape leafhopper. *J. Econ. Ent.* 39:770-774.
28. MacPhee, A. W. 1953. The influence of spray programs on the fauna of apple orchards in Nova Scotia. V. The predacious thrips *Haplothrips faurei* Hood. *Canadian Ent.* 85: 33-40.
29. Michelbacher, A. E., and W. W. Middlekauff. 1950. Control of the melon aphid in northern California. *J. Econ. Ent.* 43: 444-447.
30. Newson, L. D., and C. E. Smith. 1949. Destruction of certain insect predators by applications of insecticides to control cotton pests. *J. Econ. Ent.* 42: 904-908.
31. Pickett, A. D., N. A. Patterson, H. T. Stultz, and F. T. Lord. 1946. The influence of spray programs on the fauna of apple orchards in Nova Scotia: I. An appraisal of the problem and a method of approach. *Sci. Agr.* 26: 590-600.
32. Potter, C., and J. F. Perkins. 1946. Control of brassica pests by DDT. *Agriculture* (England) 53: 109-113. Cited in *Rev. Appl. Ent.* A,, 35: 309. 1947.
33. Ripper, W. E. 1944. Biological control as a supplement to chemical control of insect pests. *Nature* 153: 448-452.
34. Rosenstiel, R. G. 1950. Reactions of two-spotted mite and predator populations to acaricides. *J. Econ. Ent.* 43: 949-950.
35. Schread, J. C., and P. Garman. 1933. Studies on parasites of the oriental fruit moth. I. *Trichogramma. Connecticut Agr. Expt. Sta. Bull.* (New Haven) 353: 691-756.
36. Smith, C. L., and B. F. Driggers. 1944. Toxicity of DDT to *Macrocentrus ancylivorus* Rohwer. *J. Econ. Ent.* 37: 538.
37. Smith, F. F., L. P. Ditman, and L. D. Goodhue. 1945. Experiments with aerosols against some pests of truck crops. *J. Econ. Ent.* 38: 189-196.

38. Smith, R. F., and A. E. Michelbacher. 1946. Control of lygus bugs in alfalfa seed fields. *J. Econ. Ent.* 39: 638-648.
39. Steiner, H. M. 1938. Effects of orchard practices on natural enemies of the white apple leafhopper. *J. Econ. Ent.* 31: 232-240.
40. Steiner, L. F., C. H. Arnold. and S. A. Summerland. 1944. Laboratory and field tests of DDT for control of the codling moth. *J. Econ. Ent.* 37: 156-157.
41. Summerland, S. A., and L. F. Steiner. 1943. Codling moth oviposition and fate of eggs. *J. Econ. Ent.* 36: 72-75.
42. Walton, R. R., and F. E. Whitehead. 1944. Effects of nicotine dust on the melon aphis and its natural enemies. *J. Econ. Ent.* 37: 310-311.
43. Wason, E. J. 1946. DDT as a codling moth control. Experiments with apples on Murrumbidgee irrigation area. *Agr. Gaz. N.S. Wales* 57: 427-431. Cited in *Rev. Appl. Ent.*, A, 35: 317-318. 1947.
44. Way, M. J. 1949. Laboratory experiments on the effect of DDT and BHC on certain aphidophagous insects and their hosts. *Bull. Ent. Res.* 40: 279-297. Cited in *Rev. Appl. Ent.*, A, 37: 409-410. 1949.
45. Wilson, G. F. 1946. DDT: Investigations on its effect upon some horticultural pests. *J. Royal Hort. Soc.* 71: 6-13. Cited in *Rev. Appl. Ent.*, A, 35: 69. 1947.
46. Woglum, R. S., J. R. LaFollette, W. E. Landon, and H. C. Lewis. 1947. The effect of field-applied insecticides on beneficial insects of citrus in California. *J. Econ. Ent.* 40: 818-820.
47. Wright, D. W., and D. G. Ashby. 1945. The control of the carrot fly (*Psila rosae*, Fab.) (Diptera) with DDT. *Bull. Ent. Res.* 36: 253-268. Cited in *Rev. Appl. Ent.*, A, 34: 43-45. 1946.

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Hilarella hilarella (Zetterstedt) (Diptera: Sarcophagidae) Parasitic Upon a Rhaphidophorid (Orthoptera: Gryllacrididae)

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The larval stages of *Hilarella hilarella* (Zett.) have been previously reported as living on the stores in the nests of fossorial Hymenoptera. This fly is here reported as parasitizing an insect host without the intervention of any hymenopterous insect.

In the spring of 1950 at Menlo Park, San Mateo Co., California, Dr. Carl D. Duncan[1] collected two live specimens of a rhaphidophorid of a new genus and species related to *Gammarotettix*[2]. When the specimens were collected they were placed in a glass jar covered with a metal lid, without including any extraneous material, thus precluding the accidental introduction of any contaminant. From these two rhaphidophorids, seven *Hilarella hilarella* (Zett.)[3] larvae issued and pupated. Two male and five female flies later emerged. When this material was kindly presented to me by Dr. Duncan in June, 1950, the flies had all emerged and were dead, but they were all in a good state of preservation.

H. W. Allen (1926, *Proc. U. S. Nat. Mus.*, 68 (Art. 9): 5) in his discussion of the hosts of the larval stages of the tribe Miltogrammini, to which *H. hilarella* belongs, stated the "maggots live in the nests of fossorial Hymenoptera, feeding on the stores provided for their young, which may be paralyzed insects or spiders, or masses of pollen." He further stated "So far as I am aware, it has not yet been conclusively demonstrated that any of the flies are parasites of phytophagous insects in their native habitat" and that "while the flies do breed in the bodies of

[1]The writer is indebted to Dr. Duncan for his kindness in donating this interesting dipterous material.
[2]Determined by Mr. James A. G. Rehn. Mr. Rehn wrote that the two camel crickets represented a new genus and species more nearly related to *Gammarotettix* than anything known at present.
[3]Determined by Dr. H. J. Reinhard.

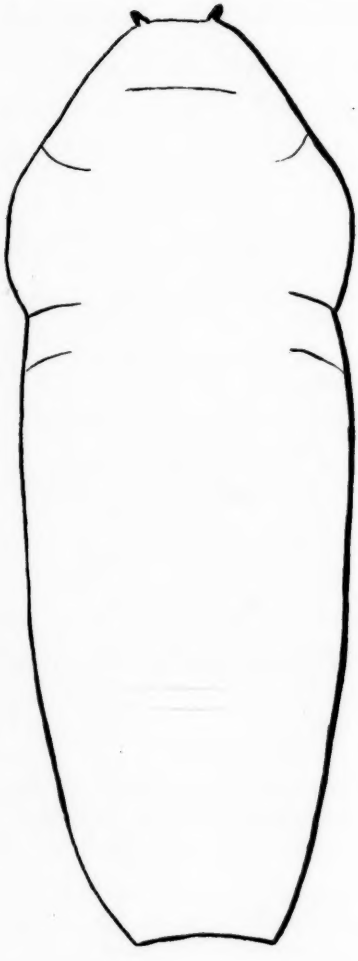


Figure 1



Figure 2

such hosts, they display no interest in them until after they have become the prey of some wasp." Allen records (p. 81) two cases where *H. hilarella* was reared from caterpillar prey of *Sphex extremata* var. *pictipennis* Walsh.

C. T. Greene (1921, *Proc. U. S. Nat. Mus.*, 60 (Art. 10): 12, & fig. 7 on plate 2) figured the lateral and end view, and spiracles of the *H. hilarella* puparium under the name *H. siphonina* Zett. A dorsal outline of the characteristic *hilarella* puparium is here illustrated in Fig. 1. The buccal armature of the third instar larva, as dissected from the puparium is illustrated in Fig. 2.

(Received February 24, 1953)

Hyalomyodes triangulifera Loew. (Diptera, Tachinidae)

By W. R. THOMPSON
Commonwealth Institute of Biological Control

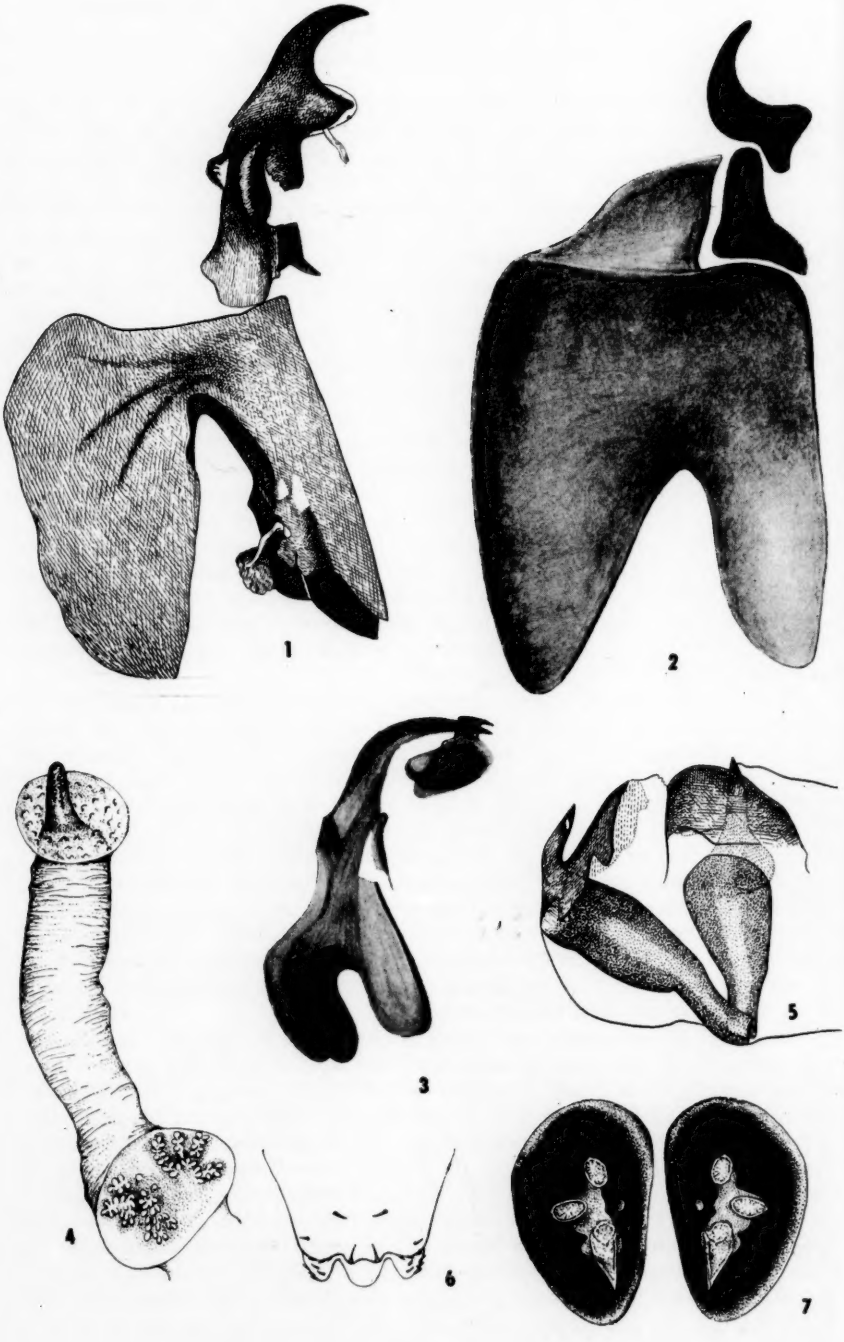
On June 8, 1910, in the woods near Brookline, Massachusetts, W. F. Fiske, then in charge of the Gipsy Moth Parasite Laboratory, collected an adult of the rare beetle *Chromatia amoena* Say (determination by the late Dr. E. A. Schwarz). Having no killing bottle, he placed the specimen in a match box. On the following day he found that the larva of a Dipterous parasite had issued and pupated in the box. The adult failed to emerge and the puparium was unfortunately discarded. In an attempt to determine something of the life history of the parasite, I dissected the dead host and found in it the first and second stage mouth hooks and the second stage posterior spiracles which were of such unusual structure that they seemed worth while describing. A short paper on the parasite was therefore published in 1913[1] in the journal published by Professor F. Silvestri, in whose laboratory I was then working.

During the following 15 years I built up a rather large collection of Tachinid larvae, of which many were described and figured; but no first stage mouth hook like that of the Chromatia parasite turned up in this material. In 1928, Miss Dorothy J. Jackson, who was investigating the biology of weevils of the genus Sitona, obtained from H. F. Hudson some specimens of *Sitona hispidula* F., collected at Strathroy, Ontario. In one of these she found a Dipterous larvae "occupying the greater part of the haemocoele"[2]. She sent this to me for examination with the remains of the host and on dissecting this, I found a first stage mouth hook identical with that of the Chromatia parasite but had still no clue to its identity, since no Dipterous parasites of either Chromatia or Sitona have been recorded from North America.

A short time ago, in looking over my collection of larvae, I turned up the slide of the Sitona parasite. It then occurred to me to look through the figures of larval mouth-parts in that mine of information, Townsend's "Manual of Myiology". Many of Townsend's figures and descriptions are inadequate but figure 346 on Plate 37 (Vol. XII) is very clear and at once suggested that the larvae found in Chromatia and Sitona are those of *Hyalomyodes triangulifera* Loew. Dissection of females of this species and of an adult of a Chrysomelid from which another individual had emerged, in the Canadian National collection, confirmed this view. The female contained larvae with a mouth-hook indistinguishable from those of the Chromatia and Sitona parasites. The Chrysomelid parasitized by *Hyalomyodes triangulifera*, contained a first stage mouth-hook of the same type together with the second stage mouth-hook and posterior spiracles exactly like those found in Chromatia.

The genus Hyalomyodes was treated in 1942 by A. R. Brooks[3]. He showed in his paper that it had been wrongly included by Curran in the genus Clistomorpha Towns. This genus, as defined by Curran, says Brooks, included representatives of four distinct genera of which two—Clistomorpha and Hyalomyodes Towns.,—belong to the Gymnosomatidae; while Psalidopteryx Towns. and Neopsalidopteryx Brooks belong to the Exoristidae. If the view of Brooks is accepted, the Chromatia parasite, on the available evidence, must be a species of Clistomorpha or Hyalomyodes. Nothing is known of the biology and larval stages of Clistomorpha. Of the species of Hyalomyodes, only two occur in eastern North America, and of these *triangulifera* is by far the more common. The parasites found in Chromatia and Sitona may therefore be referred with fair

1Boll. Lab. Zool. gen. e agraria della Scuola superiore d'Agricoltura in Portici, Vol. VII, pp. 49-57.
2Parasites of Weevils of the Genus *Sitona*. *The Scottish Naturalist*, May-June, 1934.


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certainty to *Hyalomyodes triangulifera* Loew. All the rearing records are from beetles.

Now that the identity of the Chromatia parasite has been discovered and information on all the larval stages obtained, the publication of a complete description seems worth while, especially since the original paper by the writer is not accessible to most workers in this country.

Hyalomyodes triangulifera:

STAGE I (l. 0.73 mm., W., 0.193 mm.)

The larva is rather large in relation to the size of the adult; but the specimens I have examined, though apparently well developed, have a very thin, delicate, colourless cuticle, with bands of numerous small, narrow acute spines so pale that they are difficult to study, except under the phase microscope, which makes them easily visible.

Pseudocephalon colourless, spineless, with a small, only slightly convex antenna (Fig. 10) (w. 0.0037 mm.) and a group of small punctiform maxillary sensoria; segment I with an anterior band of small acute, backwardly directed spines, composed of 7 or 8 rows on the dorsum and venter, diminishing to 4 or 5 rows in the pleural regions; somewhat laterad of the mid-ventral line, a little behind the posterior edge of the spine-band, on each side, Keilin's organ, composed of 3 elongate slender spines; laterad of this, nearer the spine band, a short rod-shaped sensorium (Fig. 20); at the lateral edge of the dorsal area, in the posterior margin of the spine band, a similar sensorium; segment II with an anterior spine band of about 9 rows dorsally, diminishing in the pleural and ventral regions to 4 or 5 rows; sensoria as in segment I; segment III with an anterior spine band of about 4 rows, the band becoming slightly narrower and the spines more sparse in the pleuroventral regions; the sensoria as in preceding segments; segment IV with an anterior spine band of 3 rows dorsally and pleurally, broadening slightly in the ventral region; a rod-shaped sensorium is present on each side of this segment and on segments V to X inclusive; segment V with a narrow dorsal band, of 2 or 3 irregular rows; the pleural region bearing an isolated group of 4 or 5 spines; the ventral region with a band distinctly broadened toward the mid-ventral line, and partly divided by a bare line into anterior and posterior halves; segment VI similar but with a bare pleural interval between the dorsal and ventral parts of the anterior spine band; segment VII with only a single row of small spines dorsally; otherwise like VI; segments VIII, IX and X bare, dorsally and pleurally; along the junction of segments X and XI, some rather long spines both before and behind the intersegmental conjunctivum; segment XI of unusual form, with fleshy pseudopodia on the posterior end (Fig. 6), the two ventral pseudopodia bearing a number of spines, the dorsal, which are less prominent, with few spines; felt-chambers of the tracheal system extremely small, vestigial, becoming thread-like anteriorly (Fig. 6); no tracheae visible in my specimens; 4 small rod-shaped sensoria on the dorsum of segment XI as shown in the figure; anal opening in the middle of the ventral side of the segment.

Buccopharyngeal armature (l. 0.093 mm.) (Fig. 3) of rather unusual form, the anterior region elongate, strongly curved, tapering to an acute point, the

3Clistomorpha, Psalidopteryx and allies (Diptera, Tachinidae): Can. Ent., Vol. LXXIV, pp. 140-150, 4 figs.

Plate 1

Hyalomyodes triangulifera Loew: Fig. 1, cephalopharyngeal skeleton, stage II; 2, same, stage III; 3, same, stage I; 4, pupal respiratory cornicle and internal spiracle; 5, posterior spiracles, stage II; 6, posterior extremity, larva, stage I dorsal view showing dorsal and ventral lobes, dorsal sensoria and posterior spiracles with filiform felt-chambers; 7, posterior spiracles, stage III.

intermediate region, opposite which is the sclerite of the salivary gland, very short, an enlargement at the junction of the anterior and intermediate regions; ventral wing of the posterior region about as long as the intermediate and anterior regions combined; chitinization rather feeble, even the anterior region pale brown; lateral plates large, irregularly oblong, apparently united dorsally above the base of the anterior tooth; sclerite of the salivary gland small.

STAGE II.

No complete larva of this stage has so far been found. I have however part of the cuticle, the buccopharyngeal armature and the posterior spiracles of two specimens.

The cuticle is colorless and transparent. It bears rows of small, pale, acute spines (l. 0.008 mm. approximately), whose exact arrangement has not been determined. Some rod-shaped sensorial organs exist. The antennae are small, broad, flattened, about 3 times as broad as long (Fig. 11).

The cephalopharyngeal skeleton, (Fig. 1) in my specimens, is rather light brown in color. (Length, 0.329 mm., anterior region, 0.0858 mm.; intermediate region, 0.0572 mm.). Progressive pigmentation of certain areas around the various parts of the skeleton has probably made its outlines much less clear-cut than at the beginning of the stage; the anterior sclerite or mandible, which is paired, as usual, is forwardly directed, only slightly curved, acute at the tip, the under side smooth, the upper side with two faint protuberances near the base; behind the base of the tooth the sclerite is produced ventrally; above the base, posteriorly, a strap-like transverse piece connects the two sides; just in front of this is a small clear foramen; the ventral projection, behind the anterior tooth, is prolonged backward as a curved strap-like piece (the intermediate region) of which the end is ventrally connected to the sclerite of the opposite side by the sclerite of the salivary gland; the intermediate sclerite is fused in front with the base of the anterior sclerite but separated behind from the front edge of the posterior region. This comprises the usual dorsal and ventral wings, whose interior margins are practically straight and meet at an acute angle; the dorsal edge of the dorsal wing is rounded, the wing short and broad; between the anterior edge of the dorsal wing and the dorsal edge of the intermediate region, there is a rather indefinite, rounded, pigmented area.

No anterior spiracles were found. The posterior spiracles (Fig. 5) (l. of felt-chamber 0.5577 mm.; width of inner two-thirds, 0.0715 mm.; of outer third 0.1573 mm.; diameter of spiracular plate, 0.429 mm.; l. of spiracular horn, outer side, 0.2145 mm.) are remarkable, of a type not known in any other Tachinid. They may resemble those of stage I, of the Sarcophagid *Acridiophaga caridei* Brethes, described by I. S. de Crouzel,[4] and of several Sarcophagids described by Smith and Finlayson[5] but, unfortunately, the figures and descriptions given by these authors are not altogether clear. The felt-chambers, which represent the terminal portion of the main tracheal trunks are rather slender and cylindrical on their inner two-thirds but markedly enlarged on the distal third; each opens into two respiratory papillae, of which one (probably the dorsal) is of the usual rounded form, while the other (probably the ventral) is prolonged into an elongate finger-like element, which is covered in turn by an elongate horn with a solid, acute tip; this horn passes at its base into the rounded, pigmented plate surrounding the apex of the felt-chamber. When these spiracular horns were originally described, an opening was figured; but I am not now certain that this exists.

[4]Proc. Ent. Soc. Wash., Vol. 46, No. 9, Dec. 1944.
[5]Can. Journ. Research, D, 28 81-117, April 1950

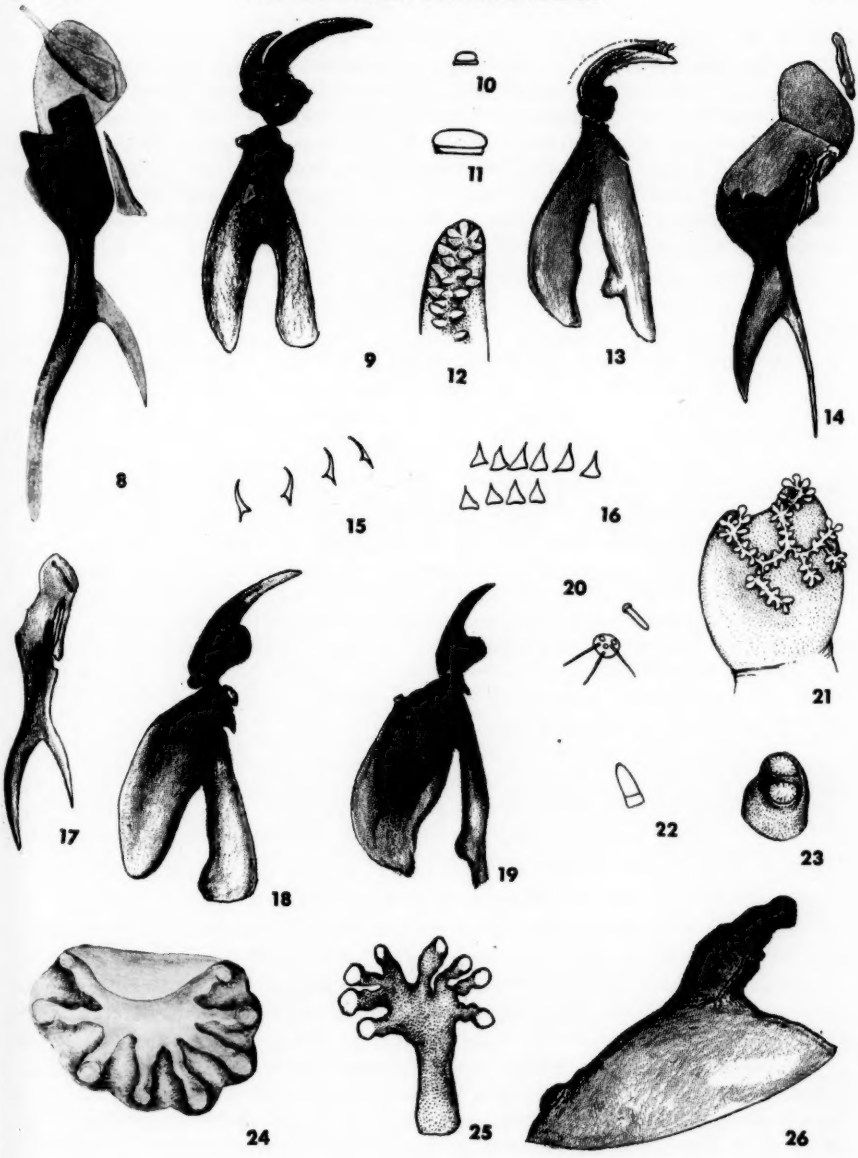


Plate 2

Fig. 8, *Psalidopteryx macdunnoughi* Brooks: cephalopharyngeal skeleton, stage I; 9, same, stage II; 10, *Hyalomyodes triangulifera* Loew: antenna, stage I; 11, same, stage II; 12, same, tip of prothoracic cornicle; 13, *P. macdunnoughi*; cephalopharyngeal skeleton, stage III; 14, *Schizactia vitinervis* Thomps.: cephalopharyngeal skeleton, stage I; 15, *P. macdunnoughi*: cuticular spines, stage III; 16, *H. triangulifera*: cuticular spines, stage III; 17, *Schizotachina convecta* Walk.: cephalopharyngeal skeleton, stage I; 18, same, stage II; 19, same, stage III; 20, *H. triangulifera*: ventral thoracic sensorium and Keilin's organ, stage I; 21, *P. macdunnoughi*; internal pupal spiracle; 22, same, antenna, stage I; 23, *H. triangulifera*, anterior spiracle, stage III; 24, *P. macdunnoughi*, anterior spiracle in puparium; same, in larva; 26, *S. convecta*, posterior extremity of puparium, lateral view showing tail and (left) anal opening.

STAGE III.

Only the puparium of this stage is available. It has been described by Greene[6] as follows: "Very small, dull, yellowish red; a depression on the dorsum of the anterior half; segmental lines of the last three or four segments plainly seen on the dorsum. Spiracles shining black, narrowly separated at the base; slightly raised above surface. Each stigmal plate has three very small, yellowish slits. Button small, not very plainly seen. Spiracles situated on longitudinal axis. Anal opening small, far below the spiracles. Length 3 mm.; diameter 1.4 mm. Some puparia do not have the segmental lines and the dorsal depression".

The puparium runs, in Greene's key, to Group E, Section 2.

To Greene's description some details may be added.

Cephalopharyngeal skeleton (1. 0.34 mm., anterior region, 0.0629 mm., intermediate region, 0.074 mm., posterior region, 0.2035 mm. approximately) (Fig. 2) similar in form to stage II, but the anterior sclerite more strongly curved and an articulation between this and the intermediate region; anterior spiracles (Fig. 23) slightly protuberant, (diameter at distal end, 0.0249 mm.) with two small oval respiratory papillae; posterior spiracles (Fig. 7) semi-oval in outline (long axis, 0.186 mm., short axis, 0.1144 mm.) with 3 small straight or circular respiratory openings, the moulting scar fairly prominent. Below the apical flat portion, the spiracular protuberances show several fine concentric wrinkles. From the ventral slit and apparently covering it at the base, is a *transparent, acute horn*, apparently homologous with the spiracular horn described in stage II (length, 0.0444 mm., width at base, 0.0222 mm.). It appears to be flattened with heavy lateral margins. Whether it is hollow or solid is difficult to decide. Since it is directed ventrally the horn of the second stage probably occupies the same position. The fact that these horns were not observed by Greene is due to the fact that they are very hard to see in the dry, pinned puparium.

The prothoracic spiracles of the pupa, (Fig. 3) in *H. triangulifera*, show the usual internal spiracle, with some 65-70 pupillae and a rather short spiracular cornicle, (Fig. 12) with some 20-25 respiratory openings. The plate surrounding the base of the cornicle is studded with small rounded protuberances. The cuticular spines (Fig. 16) are flat and triangular.

Reproductive Systems

The male and female reproductive systems are described by Townsend in the "Manual of Myiology", vol. vii, p. 202 (1938) as follows:—

Male: "Testes curved and narrowed nipple-like at origin, vehicular glands ⅔ as wide as testis and taking origin outside insertions of vasa, vas deferens only a little stouter than vasa except a slight swelling near head."

Female: "Ovaries each of about 6 ovarioles; spermathecal ducts 2½ times length of egg, sinuate and bent double, swollen on basal ⅓, at least 2 of them apparently coalesced; fecundatory glands as wide as egg and a little longer than same, their tips attached to spermathecae, their ducts ⅓ length of glands; preuterus swollen and bowed, constricted at insertion in head of uterus but not at origin; uterus in 4 coils, eggs and maggots normally set obliquely in single file but in places lying lengthwise 2 to 4 abreast, capacity 74 to 100".

The female hypopygium, as Townsend states, is small, without a piercer.

Biology

The known hosts of *Hyalomyodes triangulifera* are beetles. They are: *Haltica bimorginata* Say (Halticidae), *Lina interrupta* of authors, in part, not

[6]Proc. U.S. Nat. Mus., Vol. 60, Art. 10, pp. 1-39. 1921.

Fabricius (2), *Chromatia amoena* Say (Alleculidae), *Epilachna varivestis* Muls. and *Ceratomegilla fuscilabris* Muls. (Coccinellidae) and *Sitona hispidula* F. (Curculionidae). The taxonomic and ecological range of the host list is therefore quite wide. According to Howard and Landis, the parasite was reared from a larva of *Epilachna varivestis*, collected at Cuernavaca, Morelos, Mexico in the summer of 1930. In all other cases it was reared from the adult host and it seems probably that this is the stage ordinarily attacked. Townsend has suggested (Manual of Myiology, Vol. III, p. 82, 1936), that both Hyalomyodes and Clistomorpha deposit naked maggots, "apparently guiding them into the mouth of an abdominal or thoracic spiracle during flight of the host, for which purpose the 5 hypopygial lobes are lips are well adapted".

Since the female of Hyalomyodes has no piercing ovipositor and deposits larvae ready to hatch, in a thin-walled egg, it is fairly safe to infer that it places them on the body of the host. From time to time it has been suggested that Tachinid larvae may enter the host through the spiracles; but this habit never seems to have been observed. A delicate larva like the first stage of *triangulifera* could hardly get through the armature that protects the entrances to the tracheal system. On the other hand, the primary larva has a mouth-hook well adapted for piercing and a good equipment of cuticular spines. It seems therefore that it could penetrate the body wall of a Coleopterous larva or the dorsal abdominal surface of an adult.

The posterior sections of the main tracheal trunks in the primary larvae are thread-like and appear to be non-functional. The body wall is unpigmented and thin. It seems therefore likely that during this stage, it lies free in the body cavity of the host as do most Hymenopterous larvae. In the second stage the felt-chambers are greatly enlarged and the remarkable spiracular horns then appear. The function of these horns is at present uncertain. The horn appears to contain a prolongation of one of the two respiratory papillae and perhaps oxygen passes through it to the felt-chamber. In that case the horn may be used to pierce the body-wall (for example at the junction between segments or sclerites) or it may be thrust into one of the tracheal trunks of the host, as suggested by Crouzel for Acridiophaga. The fact that a horn persists, arising over a spiracular slit, in the third stage, suggests that it continues to function throughout the larval life. However, only careful dissections of parasitized hosts will enable us to decide the matter. Inferences from structure to function are not a substitute for direct observation.

The data so far collected indicate that the larva issues from the host to pupate. All those observed emerged as adults the same year, after a relatively short pupal period.

Systematic Relationships

The genus Hyalomyodes and other forms associated with it, were, as stated above, treated by A. R. Brooks in 1942. He then showed that the genus Clistomorpha as defined by Curran in 1927, contained representatives of a number of distinct genera: Clistomorpha Towns. and Hyalomyodes Towns. falling into the Gymnosomatidae of Townsend; Psalidopteryx Towns. and Neopsalidopteryx. Brooks, falling into the Exoristidae of Townsend. Neither of Townsend's families is well defined. In the key to the "Oestroidea", the Gymnosomatidae run out in 13 places, the Exoristidae in 10 places. This means that although the dichotomy

(2) NOTE:—This rearing record is due to Mr. W. J. Brown, of the Systematic Unit, Science Service, Canada Department of Agriculture. Mr. Brown informs me that the beetle is the species commonly cited as *Lina interrupta* (for example, in Blatchley, "Coleoptera of Indiana" p. 1160, No. 2151). A female, believed to be gravid, was collected by Mr. Brown at Point Pelee, Ontario, in June 1940. From this female a larva emerged and pupated and the puparium eventually produced an adult, determined by Mr. A. R. Brooks as *H. triangulifera*.

excludes a certain character from the family definition at a certain point, it includes it at other points. These contradictions in the definitions of families appear also in Townsend's definitions of tribes and they show that he did not succeed in classifying the Tachinids into categories higher than genera.

In the classifications of Mesnil, Hyalomyodes and Clistomorpha run to the Phasiines and then to the Dufouriina (Mesnil, 1939). This group as constituted by Mesnil, contains a number of parasites of Coleoptera.

Graphogaster and Anurogyna, together with Psalidopteryx, make up Townsend's tribe Graphogastrini. Mesnil places Graphogaster and Anurogyna in the Phasiines, tribe Dufouriina, but he would presumably not place Psalidopteryx there since it has a bristly prosternum, whereas Mesnil's (1939) key gives the Phasiines as having the prosternum bare.

Psalidopteryx has been reared only from Microlepidoptera. The larval characters of *P. macdunnoughi*, in so far as they are known, are markedly different from those of Hyalomyodes. The cephalopharyngeal skeleton of the first stage (Fig. 8) (l. 0.085 mm.) is of very peculiar construction with the lateral intermediate sclerites doubled and the anterior sclerite or median tooth not continuous with the intermediate region. The antenna (Fig. 22) is cylindrical and elongate. The second stage cephalopharyngeal skeleton (Fig. 9) (l. 0.159 mm.) has the anterior hooks (which are asymmetrical) strongly curved, the posterior region rather narrow, dorso-ventrally. The puparium has a short posterior tail without a spiracular horn; the anterior spiracles (Figs. 24, 25) present about 8 respiratory papillae, arranged in a fan in the larva, in a ring in the puparium. The Stage III buccopharyngeal armature (Fig. 13) (l. 0.615 mm.) has only one articulation, instead of two as in Hyalomyodes. The cuticular spines (Fig. 15) are loosely scattered, slender, curved and acute, instead of broadly triangular and close-set. The cornicle of the pupal respiratory apparatus (Fig. 21) is absent.

In the various characters mentioned, there is a broad general resemblance between Psalidopteryx, *Schizactia vitinervis* Thomps. and *Schizotachina convecta* Walk. The first stage cephalopharyngeal skeleton of *Schizactia vitinervis* (Fig. 14) (l. 0.056 mm.) has somewhat the same curious features as that of Psalidopteryx; the antenna is elongate and cylindrical; the posterior part of the body is slender, constituting a kind of tail; the posterior spiracles are of the usual type, without any spiracular horn. In the third stage there is also a long slender tail; the prothoracic respiratory system lacks a cornicle; the cephalopharyngeal skeleton has only a single articulation, instead of two as in Hyalomyodes; the cuticular spines resemble those of Psalidopteryx. In *Schizotachina convecta* the cephalopharyngeal skeleton (Fig. 17) (l. 0.055 mm.) is of a more usual type with a continuous pigmented connection between the anterior tooth and the intermediate region; it appears morphologically as a transition to the mouth armature found in certain Actiines; however, the lateral intermediate sclerites are double; the antenna is elongate and cylindrical; the second stage mouth armature (Fig. 18) (l. 0.172 mm.) is rather similar to that of Psalidopteryx; in the third stage the anterior spiracles are prominent with 15-17 papillae arranged in a ring; the cephalopharyngeal armature (Fig. 19) (l.0.415 mm.) has a single articulation; the prothoracic cornicle is absent; the puparium terminates posteriorly in a tail (Fig. 26); the cuticular spines are sparse and of the same type as in Schizactia and Psalidopteryx. The figures supplied will give a general idea of the resemblances and differences between the various forms mentioned. The available data are still inadequate as a guide to systematic affinities particularly since the larval stages of so many Tachinids are unknown; but it is hoped that they may be found helpful to other workers.

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